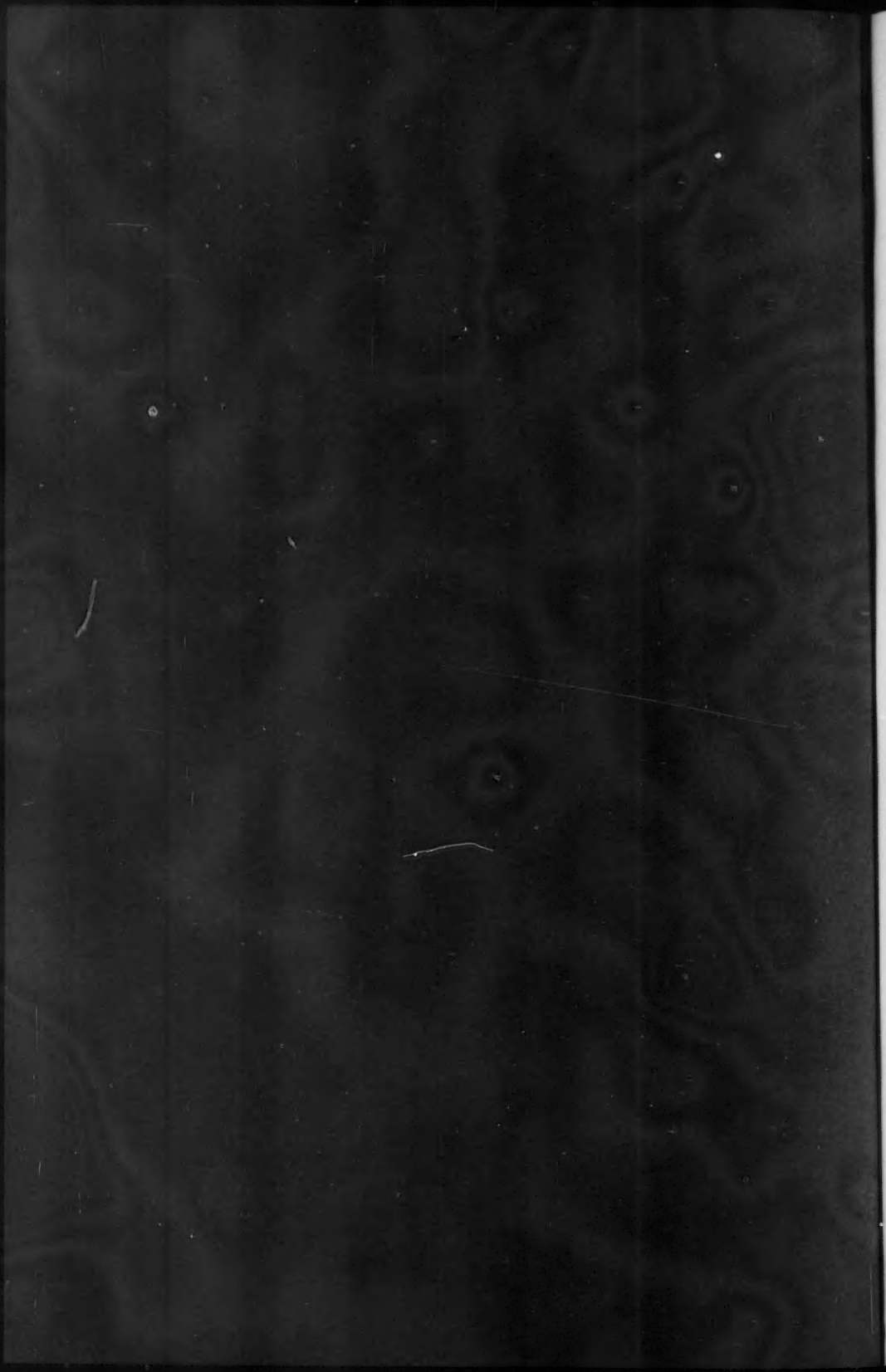
ITHACA, NEW YORK
May, 1929
VOL. II FASC. II

GENTES HERBARUM

Art. 4. De Cucurbitis Domesticatis.—I



VOL. II ITHACA, NEW YORK FASC. II

GENTES HERBARUM

(The Kinds of Plants)

By L. H. BAILEY

4. The Domesticated Cucurbitas.—I

Published
(Mailed at Ithaca Post Office to regular list)
May 13, 1929

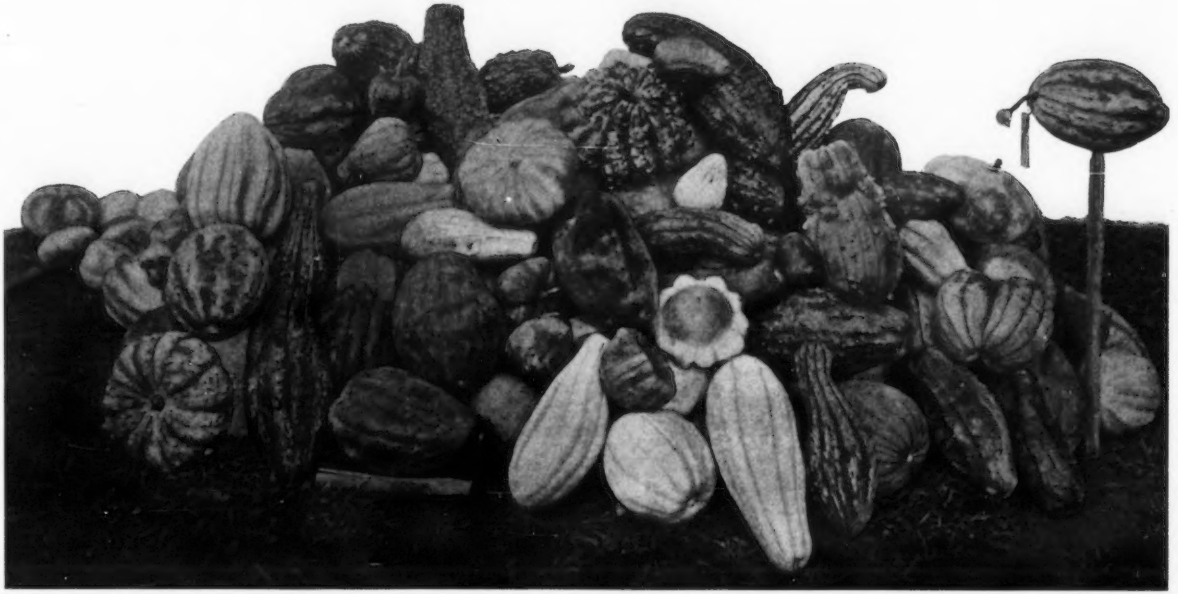


FIG. 29. A MEDLEY OF PUMPKINS.—One hundred and ten kinds, the progeny of a fruit like that on the stake at the right. Cucurbita Pepo. Ancestors are shown in Fig. 28, page 71.

ARTICLE 4. THE DOMESTICATED CUCURBITAS.—First Paper.

All the pumpkin tribes are amongst the marvels of the vegetable world in respect to their many unusual and extravagant characters. Yet they are so familiar and so exclusively associated with utilitarian uses that we fail sufficiently to appreciate and admire them.

This paper attempts to suggest some of the interest that should attach to them aside from their kitchen-garden values in both their larger horticultural and biological aspects, and to contribute something toward an orderly presentation of the diverse kinds in addition to the useful publications already available. These tribes and kinds include the commonly cultivated species and races of the genus Cucurbita, embracing not only the pumpkins of field culture but also all plants known in North America as squashes, the vegetable marrows of England, and the captivating range of little yellow-flowered gourds.

The energy stored in the flat simple seeds is amazing, so quickly they germinate and so strongly the plants grow in the short warm season with such a seemingly small and incompetent root-system and such tenderness to wind and drought and frost. They take possession, covering and smothering lusty weeds and running rampant over fences and sward and mounting trees within their reach. A short time ago (in The Garden Lover) I stated that one spring I planted a seed of a gourd in my greenhouse. "It covered a long bench, ran out the ventilators at the top of the house, down the roof and on the ground, full 100 feet by the time frost overtook it. Such energy is quite beyond comprehension". This record is equalled if not overpassed by Dr. Robert T. Morris, eminent surgeon, who writes in the last October-November-December number of The Guide to Nature that from a single seed of the Turban gourd he obtained a wheelbarrow load of fruits and 825 feet of vine, in his garden in Connecticut.

The kinds of fruits that these plants bear are protean. They are among the most interesting bodies in nature as one sees them assembled in test-grounds, at exhibitions, in large markets, or loaded full in sailing ships in the tropics. They range from gourds that weigh only an ounce or so to monsters of more than 200 pounds, and similarly limitless in shape, color, markings. Even the size of seeds varies widely. And the mystery of it is that nobody knows why. It is easy enough to say that they hybridize; but where and why did the forms originate, and what is their significance in the natural history of the species?

Before me as I write is the Cucurbita herbarium of the late E. Lewis Sturtevant, once Director of the Agricultural Experiment Station at Geneva, New York. This is not an herbarium in the usual sense although the labels are the same, but mounting-sheets of the regulation size are pasted with pictures clipped from catalogues, tracings of illustrations in the old herbals, colorful paintings made from life at Geneva by his wife or daughter, extracts from the Sixth Report of the Geneva Experiment Station, and ceaseless notes in his small inimitable script. These pictures and notes are in the hundreds, on 46 sheets representing *Cucurbita moschata*, 55 of *C. maxima*, 67 of *C. Pepo*. This unique collection he presented to me long years ago, for we admired these plants together. These 168 sheets comprise a veritable wonder-book, bringing together a marvellous range of natural objects.

The general impression in looking at such a collection is of the multiplicity and instability of forms. And yet certain kinds appear now and then with a constancy that remains through generations of men: witness the common Connecticut Field Pumpkin, the Custard or Scallop kinds, the Summer Crooknecks, the Hubbard Squash, the Boston Marrow. Kinds pictured by the old herbalists we can match in our gardens today.

Attention should also be called to the flowers of these protean forms, for the artist and nature-lover as well as the botanist should find delight in them. They are born of the night and perish with the heat and sun of the first morning; within that time the bees have found them and the functions have been perfected. Yet for all this brief existence, they are marvellous in their shape and color and in their tenuous frangible structure. Few objects excel them in the grace of their curve and line. They are fascinating to photograph if one is ready before the sun is high, when the parts are clean and untorn. One cannot conceive that all these conformations and qualities are essential only to fecundation and the perpetuation of the species. The very fugitiveness of these diaphanous blossoms whets the quest of those who search for reasons.

The plants, with their odd and endless fruits, have lent themselves well to description. The old herbals abound in them. Yet it is difficult to devise a systematic treatment that will contain them as species and botanical varieties and reduce them to something like a taxonomic order. Herbarium specimens for record do not answer the questions, although they are essential. One must have the fruits; and the difficulty with printed pictures is that the fruits are not associated with the foliage and flowers and habits to which they belong, and the botanist may search no end of separate illustrations and not be greatly informed. One cannot rapidly define the fruits so that they can be well visualized. In this paper it is attempted to place the pumpkins and squashes and yellow-flowered gourds into their

botanical species, and this can be accomplished only with the use of many pictures of known relationships.

The reader must know, however, that there is no finality in a writing of this character, for even the pumpkins and squashes are not yet sufficiently studied in respect to their species and classification. The morphology of the ovary and its attachments, and of the styles and stigmas, is particularly in need of investigation from the point of view of origins and relationships

The paper divides itself into seven parts:

The origin of pumpkins and squashes, page 65.
Cross-breeding and hybridizing, page 67.
Inside the pepo, page 75.
The Linnæan conception of Cucurbita, page 78.
The systematology of the cultivated Cucurbitas, page 87.
The case of the turbans, page 108.
Synonymy in the cultivated Cucurbita group, page 112.

In the preparation of this paper I have naturally had many aids through the years. I remember particularly suggestions recently made by Professor A. T. Erwin of the Iowa State College, Paul S. Martin of the Colorado Historical Society, Dr. G. P. Van Eseltine of the New York Agricultural Experiment Station at Geneva, Drs. Arthur J. Eames and Paul Work of the New York State College of Agriculture at Cornell University, Dr. John Hendley Barnhart of the New York Botanical Garden.

THE ORIGIN OF PUMPKINS AND SQUASHES

Pumpkins and squashes, as we now understand them, are unknown in a native wild state. This is one of the enigmas in the plant world. But the earth is yet little explored for such things and our interest in the botany of the group is not sufficient to make the search thus far conclusive. The fact that there is an apparently native undefined Cucurbita in southern Florida suggests how little we know about these kinds of plants. If there has been an unrecognized kind in Florida, may there not be others in Mexico or Central America or elsewhere that have some relation to the origin of the cultivated kinds? In fact, John K. Small asks the question, "Have we found the original home of this garden esculent?" in the title of his interesting account of the Florida wild pumpkin in the Journal of the New York Botanical Garden in 1922. This wild gourd I have collected by Lake Okeechobee and have grown the vines, and hope to have more to say about it in due time.

Long before the Florida gourd was known to botanists, another one had come to light in south-central Texas, collected by Lindheimer. This was published by Scheele in 1848 (Linnaea, xxi, 586; also xxii, 352) as *Tristemon texanum*, a new genus, and two years later transferred to

Cucurbita by Asa Gray. It was also cultivated in the Botanic Garden at Cambridge, Massachusetts, from seeds taken in Texas. The plant was first collected on the upper Guadeloupe, "apparently indigenous". It is a gourd. Gray wrote that the pyriform fruit is just that of *Cucurbita ovifera*, and thought the plant may be only a naturalized variety. There are good botanical specimens of it in the Gray Herbarium from different sources. It was collected in 1849 by Charles Wright in western Texas, and in 1882 by Havard at Rio Concho, Texas, showing that the plant had a considerable distribution and that it had persisted for a third of a century. The same or a similar plant was collected by Berlandier in 1835 on the San Fernando, Texas. The herbarium specimens are of the Pepo kind, and yet there are small differences but whether only incidental cannot be said. The plant is commonly dismissed as a run-wild thing. "The common pumpkin has a naturalized variety in southern and western Texas, the habit, foliage, and fruit of which is too well known to need description", is the entry in Coulter's Botany of Western Texas. Alphonse DeCandolle mentions *C. texana* in his Origin of Cultivated Plants and does not dismiss the idea that it may be native, and he is sympathetic to the suggestion of a Mexican or Texan origin of *Curcubita Pepo*. I hope to overtake the Texan plant in the wild.

The literature is readily accessible on the Cucurbita seeds and remains that have been found in burial places and elsewhere in the western hemisphere, and fresh evidence has been assembled, reference to which need not be entered here. We are to expect additional remains in the new explorations. Professor A. T. Erwin of the Iowa State College, who has made important studies in Cucurbita, has sent me excellent photographs of seeds, fruit-stalks and of a piece of shell collected in 1928 at Mesa Verde and Ackmen, Colorado, in the archaeological explorations of the Colorado State Historical Society. He thinks that they represent *Cucurbita moschata* and *C. Pepo*. Mr. Paul S. Martin, Curator of Archaeology and Ethnology of the Society, writes me that he regards the specimens as prehistoric, and he sends me a few of the priceless seeds, charred with age, collected near Ackmen. I think these seeds are *C. moschata*, a species seldom associated with an American origin, although DeCandolle arrives at no conclusion on the nativity of it. Mr. Martin writes that the articles were found in a peculiarly shaped vessel and adds that they were buried with a culture that he thinks antedates the great cliff houses, and that probably represents a civilization that flourished at least a thousand years ago and possibly longer than that. The inhabitants of the period may be regarded as the ancestors of the modern Pueblo Indians.

Perhaps these unrelated remarks on origin are sufficient to suggest that we have not yet exhausted the field of exploration within the boundaries of the United States.

CROSS-BREEDING AND HYBRIDIZING

For the moment I restore the old phrase "cross-breeding and hybridizing" that was current before the term plant-breeding came into use and which, in turn, has been absorbed in the great science of genetics; for I undertook manipulation experiments with the cucurbitas and other plants before we spoke of plant-breeding, before Mendelism was a subject of discussion, before biometric tabulations were employed, and before cytology was brought to bear on the subject. It was before the system of Federal Experiment Stations was under way. The brief account now presented is reminiscent of another day and approach, and I like to recall for the last time the forgotten phraseology of that period. In those dim years we were still thinking about "the production and fixation of varieties", following the stimulating writings of Verlot and Carrière. Perhaps it is still well not to overlook these objectives.

These Cucurbita tribes are tempting to the hybridizer. The plants are prompt, giving results speedily. They take care of themselves, requiring no great skill on the part of the grower. The flowers are big and unisexual, allowing simple manipulation. The results are certain to be astonishing. They have been entertaining subjects for experiment since the days of Duchesne, Sageret, Gasparrini, and Naudin; and every succeeding generation has its own enjoyment in the quest.

More than forty years ago I became fascinated of the hybridization of pumpkins and squashes and gourds, and my enthusiasm consumed many acres of land. In one year eight acres were covered with the progeny of a single set of crosses. All the recorded pollination in the old experiments was under control and performed by hand, the flowers being bagged securely. Great numbers of photographs recorded the forms, together with full notes tracing the results through several generations. The work ran over a period of some years, in two States. More than 1000 experiments were made, including several hundred hand crosses, and probably as many as 2000 nondescript forms of pumpkins and squashes were produced. The extent of the effort terminated itself, for the results were too voluminous to publish in full; this is a limitation that intending hybridizers must consider, for the results are rapid and the fruits bulky and only good pictures, and preferably paintings, can represent them.

Results appeared in print here and there, and for years in my teaching. The fullest report, with rather extensive tabulation for those days, with photographs and lantern slides, was prepared for the International Conference on Plant Breeding and Hybridization, in New York City, 1902, under the auspices of the Horticultural Society of New York. As the Conference was under the necessity of hearing other papers also, only a brief summary of some of the conclusions was presented, under the title "A

Medley of Pumpkins" (page 117 of the Report). Long before this date, however, some of the results had been published in Bulletin 25, Third Report of the Cornell University Experiment Station, 1890, and in my "Plant-Breeding," 1895. The essential summaries are here brought together inasmuch as the early publications are inaccessible to most persons, and the account is extended from unpublished manuscripts still in my possession, for whatever historic interest the experiments may possess.

At that time the opinion was still current that cucurbits of many kinds "mix in the field", by which it was meant that there is an immediate influence of pollen on the character of the fruit. The wildest notions were held, not only that pumpkins "spoil" squashes but that they also upset melons and cucumbers. It was in part to test such opinions that the experiments were begun; and there was also the desire to determine whether by crossing we can produce good and stable garden varieties. The experiments answered both questions in the negative.

Immediate effect of pollen.

The uniform results of these experiments show that there is no xenia or immediate effect of crossing in the pumpkins and squashes. This work corroborates that of a number of other experimenters. It will be found that one vine in general field and garden operations bears essentially one kind of fruit, indicating that the character was derived from the seed and not from the influence of pollen on the individual flowers.

Empty or seedless fruits.

Unusual crossings sometimes resulted in the production of apparently good fruit. For example, a Bush Scallop [*Cucurbita Pepo* var. *Melopepo*] crossed with pollen of cucumber produced a fruit to all appearances normal but it was empty. Some of the hybridizations between different species of Cucurbita, as *C. Pepo, C. maxima, C. moschata*, gave similar results.

"I am not positive" I wrote in the manuscript at the time, "whether these pericarps were made to grow to their normal size through the influence of the foreign pollen or whether there may not have been other influences as there is in the case of the hothouse cucumbers, fruits of which will develop to large size without any pollen whatever. However, many tests were made by withholding pollen from the flowers, but in no case did the ovary develop to any size.

"It is a common opinion, for example, that muskmelons are rendered insipid and worthless when cucumbers are growing in their vicinity. Close observations in the field will convince any person of the fallacy of this idea, but experiments were undertaken to test the case. Muskmelon flowers

were pollinated with cucumber flowers, both in the house and in the open. In one test, ninety-seven muskmelon flowers of various kinds were pollinated by cucumber flowers of various kinds, but no fruits developed. Twenty-five cucumber flowers at one time were pollinated by muskmelon pollen but only one fruit developed and that was seedless. These experiments and others coincide with those made by other investigators that cucumbers do not spoil melons".

Infertility.

An interesting result of these old experiments was the fact that squash and pumpkin flowers are nearly always infertile with pollen produced on the same vine (that is, with individual pollination). As the plants are monœcious, there cannot be close-fertilization, but sterility inheres in the vine. Careful tests, involving many pollinations, were made on this subject with more than fifty varieties. Out of the whole number only seven fruits with good seeds were obtained in pollination of pistillate flowers from staminate flowers on that plant. In most cases the ovary refused to develop. Sometimes the ovary remained alive for a few days and enlarged to two or three times its size at anthesis, but in most tests it finally perished, beginning to die away from the blossom or pistil end. In some examples, however, the fruits matured, being to all appearances normal, but they were empty or produced only hollow seeds.

In one experiment with varieties of *Cucurbita Pepo* representing both summer squashes and hardshell gourds, nearly 200 flowers were hand-pollinated, in each case from the same plant. Nearly all the flowers failed to develop ovaries. A few of the fruits grew to full maturity and appeared to be normal squashes in every way. Some of them, however, were wholly seedless, the seeds being represented by small undeveloped seed-coats. In a few others the seeds appeared to be good, but when opened they were found to be destitute of embryo. Only seven fruits bore good seeds, and even in some of these the seeds were very few. All the seeds from these seven fruits were carefully sown and recorded: the progeny was just as variable as that grown from crossed seeds. The results of the progeny of the seven were these:

Fruit No. 1. Four plants were obtained, with four different types, two of them being white, one yellow, and one black.

Fruit No. 2. Twenty-three plants. Fifteen types very unlike, twelve being white and three yellow.

Fruit No. 3. Two plants. One type of fruit which was almost like one of the original parents.

Fruit No. 4. Thirty-two plants. Six types, differing chiefly in size and shape.

Fruit No. 5. Twenty plants. Nineteen types, of which ten were white, eight orange, one striped, and all very unlike.

Fruit No. 6. Thirteen plants. Eleven types,—eight yellow, two black, one white.

Fruit No. 7. One vine.

Hybrids of two species.

In the work with cucurbits, there were numbers of attempts to combine the three species *C. Pepo*, *C. maxima* and *C. moschata*. It was a common notion with gardeners that these three species intercross interminably. All efforts to combine the three species have failed, and I became convinced that under common garden conditions none of these species habitually hybridizes.

It is possible, however, to amalgamate *C. moschata* with *C. Pepo*, and a definite result was secured in this direction in 1892. The result of many pollinations was seven fruits of the following progeny:

Common ornamental gourd (*Cucurbita Pepo* var. *ovifera*) by the Japanese Crookneck (*C. moschata*).

The Fordhook Bush Pineapple squash (*C. Pepo* var. *Melopepo*) by Butman squash (*C. maxima*).

The Connecticut Field pumpkin (*C. Pepo*) by the Japanese Crookneck (*C. moschata*). Of these two fruits were obtained.

Japanese Crookneck (*C. moschata*) by Red Etampes squash or pumpkin (*C. maxima*).

Boston Marrow squash (*C. maxima*) by Green Striped Bergen Bush Scallop (*C. Pepo* var. *Melopepo*).

Early Sugar pumpkin (*C. Pepo*) by Red Etampes squash (*C. maxima*).

In all these crosses there was no immediate effect of pollen. In four of the cases, although the fruits themselves were well grown, there were no perfect seeds. Sometimes the seeds were full grown and plump, but empty. Only three fruits gave seeds. These were the gourd crossed by the Japanese Crookneck, and two fruits of the Field pumpkin crossed by the Japanese Crookneck. These were crosses between *C. Pepo* and *C. moschata*.

From the two Field pumpkins crossed by the Japanese Crookneck eighty-eight plants were grown the following year, 1893. The progeny fell into about eight types, although there were only four or five well marked forms. Most of them were like a small orange pumpkin. Some were small green pumpkins. None of them showed any influence of the staminate parent, the Japanese (*C. moschata*), except that in a few the scar of the blossom end was very large, which is usually not the case in the varieties of *Cucurbita Pepo*. One of the forms simulated a Bush Scallop squash of light lemon color. One was striped. All the forms had the fruit-stems of

C. Pepo. [In the language of the present day, the characters of *Cucurbita Pepo* were dominant.]

It will be noted that the successful issues were one-way crosses, *C. Pepo* pistillate by *C. moschata* staminate. The reciprocal crosses did not yield good seeds.

Crosses were made in 1893 between some of these progenies, care being taken to choose pistils and pollen from plants that were bearing very similar fruits. Of many crosses only one fruit matured and progeny was not produced. The experiment had a natural termination.

The following paragraph on hybridity between species is in the Cornell Report for 1890: It is easy to find fruits in any large assortment of pumpkins or summer squashes which might be taken for hybrids with the Hubbard or Turbans by a casual observer. But none of these fruits which has come under my observation—and I have seen hundreds—possesses any marks of hybridity, and the fruits have occurred in our experiments among pedigree stock that had no *Cucurbita maxima* blood in it. These so-called hybrids are nothing more than incidental variations of *Cucurbita Pepo*, and they may appear anywhere at any time.

One hundred and ten.

In 1887 a Summer Yellow Crookneck and a Summer White Bush Scallop [both *Cucurbita Pepo* var. *Melopepo*] were crossed, the Crookneck being the pistillate parent. The varieties were stable commercial stock, showing no important variation in the field. Two good fruits were obtained from the cross-pollinations; they were typical Crookneck squashes, yellow, warty, differing in no regard from the other fruits on the vines. One of the crossed squashes is shown in Fig. 28, uppermost fruit (Bulletin no. 48, Experiment Station, Agricultural College of Michigan, 1889, by L. R. Taft.).

FIG. 28. CROSSES.—A crossed squash above (1887), and two progenies of the cross below 1888). The final issue is shown in the frontispiece, Fig. 29.

Seeds of these two fruits, which we may call A and B, were planted in 1888, with the following results:

Squash A. From the one fruit, three types were produced (in 1888), all of which may be considered as blends between the two parents, although they partook more of the nature of the White Bush Scallop or pollen-bearing variety, being white and not greatly elongated. None of the plants reproduced either parent. In some cases the effect of the seed-bearing parent or Crookneck was shown in the tendency to lengthening of the main axis and in the production of warts or excrescences. Seeds of this parent squash were planted in 1888 on sandy soil and others on muck. Although the general type forms were the same in either case there was, nevertheless, noticeable difference between the two lots. The fruit grown on the light soil had shallower creases and fewer warts than those grown on the muck.

One fruit in the 1888 progeny of A (which we may call A1) was somewhat oblate, with a few ridges that were rather deep at the stem but running out at the blossom end, and with a few large warts.

Squash B. (Crop of 1888). This squash produced three general types. They were white like the pollen parent, but they were also thickly studded with warts, much like the seed parent. Some of them had necks but most of them were flattened and with deep scallops, similar to those of the White Bush. In this case there seemed to be more influence of the seed-bearing parent or Crookneck than in the other. As in A, there were no reproductions of either parent, but the fruits were blends of various degrees.

The two lower fruits in Fig. 28 are of the 1888 progeny.

In 1888, some of the flowers were hand-pollinated among themselves and some were not; but seeds were saved from all the fruits and planted in 1889 in a field by themselves in New York. Fifteen diverse types were obtained in 1889, but only one fruit seemed to have any merit from the gardener's point of view. This was a large shapely squash which appeared from the progeny of A1, the attractive squash of 1888. It was an oblong-shaped fruit, ten inches in length, something like a vegetable marrow in form, of a bright lemon color, splashed and striped with orange, and bore no immediate resemblance to either Crookneck or White Bush. The seeds were large and pumpkin-like rather than small and thin as in the case of the Bush squash from which it sprang. It proved to be edible. This fruit was examined by an expert seedsman who pronounced it to be worthy of introduction in case it could be fixed so as to come true to seed. He informed me that he had fixed squashes by breeding in and in, that is, pollinating them from flowers of the same plant.

Every seed of this one fruit (which was called Alpha), was saved and a large area was planted with it in the spring of 1890. An excellent detached sandy field was secured for the purpose, so that the plants could have the best opportunity to make the most of themselves. Of all the plants only

one produced a squash like the Alpha parent, (and which we may call Alpha 2nd), and on this experiments were begun by in-breeding (individual pollination). As fast as the pistillate flowers appeared on this one plant, they were pollinated from staminate flowers on the same plant, but it was soon found that none of the fruits was going to set. Therefore the field was carefully scrutinized in the hope of finding another plant so closely like it as to be worth while to breed them together. Two or three similar plants and fruits were found, and crosses were made between the Alpha 2nd and these. Two fruits finally matured, the result of crossing between two plants, the pistillate parent being Alpha 2nd.

Every fruit in the plantation was harvested in the autumn of 1890 and it was found that every plant of that year bore a different character of fruit, only three or four of them were similar to each other and to the Alpha parent, and only one, as has been said, reproduced the parent with any degree of exactness. I actually counted 110 kinds that were distinct enough to receive names and to be described in case it were thought worth while to do so. The brood is seen in Fig. 29, and Alpha 2nd sits separately on its stake. Beside these there were a few minor variations of which no note was taken. The fruits were of every conceivable shape and of many shades of yellow and orange, and running into clear whites. In all the batch there was only one fruit that seemed to be promising as a commercial variety and that was the single one (Alpha 2nd) that was so like the parent.

I still had hopes that the two hand-pollinated fruits of Alpha 2nd would reproduce the parent form (either of itself or of Alpha of 1889), and seeds of them were planted in 1891; but not one seed reproduced it, although these seeds were the product of hand-pollination between known plants bearing closely similar fruits. However, there was greater uniformity than in 1890, and a general absence of monstrous, warty and grotesque forms. Nearly all the fruits were shapely, and many of them were beautifully striped. A number of them were double fruits. One squash produced twenty different types, and the other an even dozen. Since none of these fruits seemed to promise much in the way of gardener's varieties, this particular undertaking was not carried further, since its purpose was not primarily to study laws of hybridity.

It is needless to multiply examples. I became convinced that the production of good new varieties was not by means of hybridization. I then undertook plain selection from promising fruits as they appeared in the field of commercial kinds and followed the work attentively through hundreds of examples. Again there was no practical result; but this set of experiments really did not differ from my hybridizings except that in this case the parents were not known.

Prospect.

The need now is for genetical studies in the Cucurbitas, conceived in the strictest method, and they are being undertaken by different persons. The procuring of unmixed stocks to start with is a real problem, and of course such stocks must be tested in isolated places where danger of contamination is eliminated. Studies of the nature and course of variation in these plants are essential. Much land will be required, under full control. The botany of the groups must be given close attention, as a matter of identification. The prospect is fascinating.

The intending investigator in this tempting field may familiarize himself with the stimulating work of Charles Naudin, seventy-five years ago, and others before him. Investigations in future may well consider the entire plant and not alone the characters of flowers and fruits. Probably we have too exclusively confined our attention to fruit-forms. Morphological and cytological studies should accompany the breeding investigations. This requires cooperative effort. I have not followed all the recent literature, but here is some of it aside from that mentioned elsewhere, considering Cucurbita and not including writings only on related genera:

Cogniaux, A. Cucurbitaceae-Fevilleae et Melothriae, in Das Pflanzenreich iv, 275. i (Heft 66), 1916. Continued by A. Cogniaux and H. Harms as Cucurbitaceae-Cucurbiteae-Cucumerinae in Das Pflanzenreich, iv. 275. ii (Heft 88), 1924. This monograph, as far as received, has not yet reached the genus Cucurbita.

Bushnell, J. W. The Fertility and Fruiting Habit in Cucurbita. Proceedings American Society for Horticultural Science, xvii, 47-51. 1920; also Isolation of Types of Hubbard Squash by Inbreeding, vol xix, 139-144. 1922. See also W. H. Alderman, Report Division of Horticulture, Minnesota Experiment Station, 1921 and previously.

Cummings, M. B. and Stone, W. C. Yield and Quality in Hubbard Squash. Bull. 222, Vermont Agricultural Experiment Station, 3-48. 1921. Continuation by Cummings and Jenkins, Vt. Bull. 280. 1928.

Zimmermann, A. Die Cucurbitaceen. Beiträge zur Anatomie, Physiologie, Morphologie, Biologie, Pathologie, and Systematik. 1, 2. Jena. 1922.

Sinnott, Edmund W., and Durham, George B. Inheritance in the Summer Squash. Journal of Heredity. April, 1922, pp. 177-186.

Sinnott, Edmund W. Inheritance of Fruit Shape in Cucurbita Pepo. Botanical Gazette, lxxiv, 95-103. 1922.

—— A factorial analysis of certain shape characters in squash fruits. American Naturalist, lxi, 333-344. 1927.

Vuillemin, Paul. Recherches sur les cucurbitacees. Annales des Sciences Naturalles, Botanique Ser. x, xix, 5. 1923.

Neitsch, E. Die Morphologische Natur der Ranken der Cucurbitaceen. Beiheft xviii, Fedde's Repertorium Specierum Novarum regni vegetabilis. 1923.

Tapley, W.T. The Fruiting Habit of the Squash. Proceedings American Society for Horticultural Science, xx, 312-319. 1923.

Holroyd, Roland. Morphology and physiology of the axis in Cucurbitaceæ. Botanical Gazette, lxxviii, 1-45. 1924.

Durham, George B. Has parthogenesis been confused with hermaphroditism in the Cucurbita? Zeitschrift für inductive Abstammungs- und Vererbungslehre, xxxvii, 358-361. Leipzig, 1925.

Articles in Bulletin of Applied Botany and Plant-Breeding, xiv, no. 2. Leningrad. 1925: N. Vavilov, Inter-generic hybrids of melons, watermelons and squashes, pp. 3-35; F. Koslov, On species hybridization in melons and cucurbits, pp. 71-78; S. Kartashov, The root-system of water-melons, melons and cucurbits, pp. 79-87.

Castetter, E. F. Microsporogenesis in *Cucurbita maxima*. American Journal of Botany, xiii, 1-10. 1926.

Pirovano, Alberto. Fiori ermafroditi nelle "Cucurbita" ibride elettrogenite. Annali di Botanica, xvii, fasc. 3. Rome, 1927.

Robinson, L. R. The Cucurbits. Pub. by J. C. Robinson Seed Co., Waterloo, Nebraska.

INSIDE THE PEPO

As one cuts across a ripe pumpkin or squash (a fruit known to botanists as a pepo) the central mass seems to be formless. This is because the placentæ or seed-bearing walls break down in age. Often all that remains of the internal structure is one great cavity with the seeds hanging from the slippery shreds.

FIG. 30. A PEPO.—Diagrammatic cross-section of a fruit of Cucurbita Pepo. (Baillon).

To understand the structure, one must go back to the ovary or young fruit. The ovary is three-carpelled, corresponding to the three stigmas. The diagram Fig. 30, from Baillon, shows the ovary in cross-section, interpreted by him as morphologically one-celled, nearly filled with three thick placentæ, "the thick incurved margins of which bear an indefinite number of ovules of various ages, nearly horizontal, anatropous, each embedded in a cellule formed around it by the hypertrophiated placenta" (The Natural History of Plants, viii, 394). The three projected placentæ are represented by the straight lines in the diagram. Whether the pepo is to be described as one-celled or three-celled is largely a question of personal interpretation, depending on the extent of fusion of the parts in the particular type of fruit under consideration.

We may now turn to a cross-section of two mature Hubbard squashes (*Cucurbita maxima*), shown in Fig. 31. The carpels have grown enormously larger, of course, than in the young fruit and the position of the seeds may have changed (and the cutting of the squash is likely to displace some of the seeds). The upper picture shows clearly what has taken place. At *g* are the carpellary cavities. In the lower figure the central core has broken away and one great irregular cavity remains.

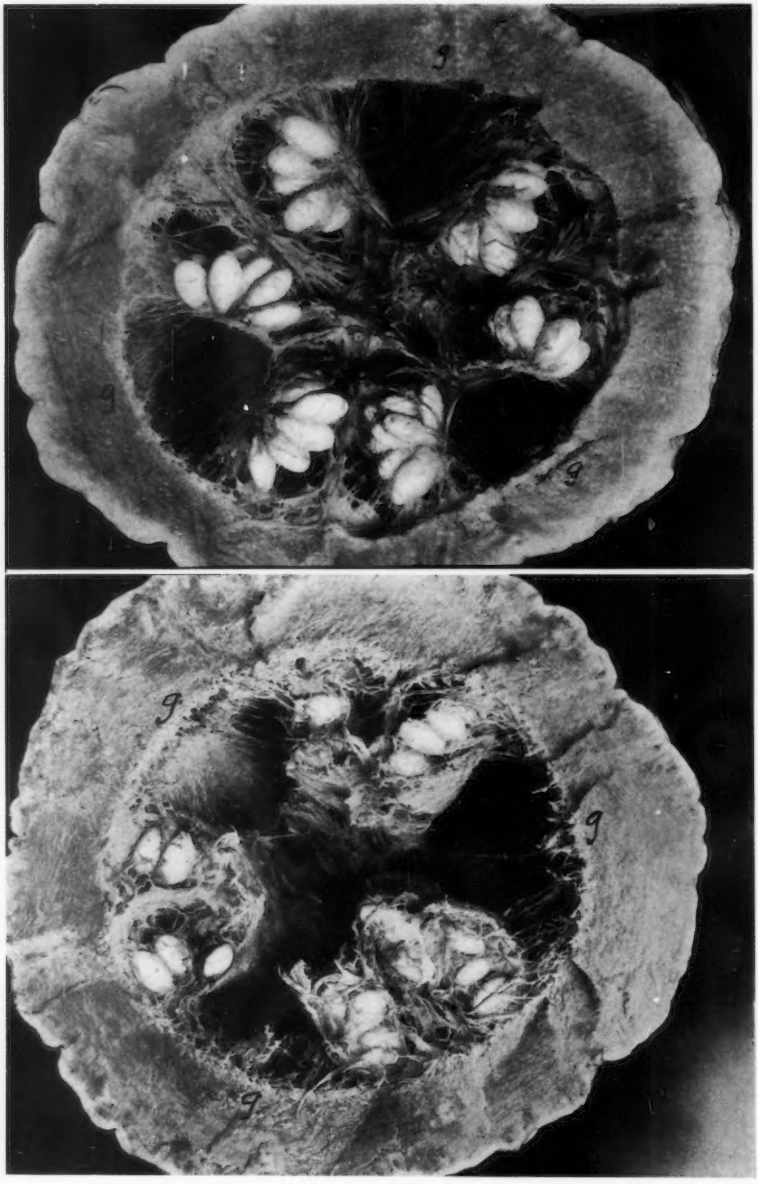


FIG. 31. HUBBARD SQUASH.—Cross-section of ripe fruit. Cucurbita maxima.

Sometimes there are more than three carpels, particularly in the so-called Turban forms of *Cucurbita maxima* (Fig. 57). The Fig. 32 shows a fruit of the Turban squash with five carpels; and these carpels are projected into the "turban," or inside squash, that emerges from the top of the pepo. The turban is an exaggerated example of polycarpy, probably analagous to the naval in the orange and the turks-cap or projection in some of the tomatoes. Cucurbita flowers show many abnormalities or exceptions.

It is to be noted that in Tournefort's picture of Melopepo (Fig. 34), five carpels or cavities are shown, whereas in Pepo there are three. In his Cucurbita (which is our Lagenaria) six cells are shown; this is probably a

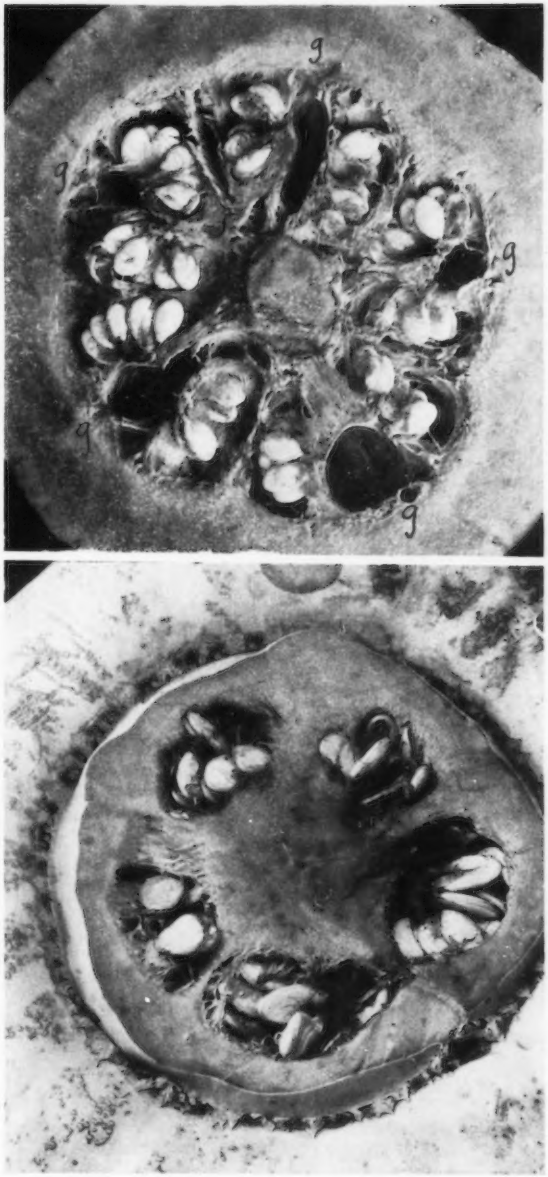


FIG. 32. TURBAN SQUASH IN SECTION.—Above, body of the squash, 5-celled; below, across the turban or cap. Cucurbita maxima var. turbaniformis.

formal diagrammatic representation of the dividing or lobing of each of the three carpels. We shall find that Linnæus accepted the three-loculed fruit in the diagnosis of his genus Cucurbita.

It is not the purpose of this article to analyze the morphology of the pepo. Persons desiring to study this subject should consult Heft 2 of A. Zimmermann, Die Cucurbitaceen, Jena, 1922. A hundred years earlier the morphology had been studied by Auguste Saint-Hilaire,—Mémoire sur les Cucurbitacées, Paris, 1823.

THE LINNÆAN CONCEPTION OF CUCURBITA

All current accepted binomial nomenclature begins with the first edition of Linnæus' Species Plantarum, 1753. Fig. 33 is the Cucurbita part of his page 1010, the last part of which, however, is continued on page 1011. Linnæus described five species of Cucurbita at that time,—*C. Lagenaria, C. Pepo, C. verrucosa, C. Melopepo, C. Citrullus.* The first one is the white-flowered gourd, now known as *Lagenaria leucantha* (*L. vulgaris*). The last one is the watermelon, known as *Citrullus vulgaris.* Specimens of both these species, the first one and the last one, are in the Linnean Herbarium, and I have photographs of them; they are the plants we now know as *Lagenaria leucantha* and *Citrullus vulgaris.* The other three are Cucurbitas of the Pepo group, for which we shall account as we proceed.

If the type of a genus is considered to be the species standing first on the original printed page (other criteria being absent), then *Cucurbita Lagenaria* or the white-flowered calabash gourd is to hold, and the other species go into other genera: thus *Cucurbita Pepo, C. verrucosa, C. Melopepo,* then go into the genus Pepo of Philip Miller, 1754, who at that time followed the herbalists and pre-Linnæans. The generic name Pepo is adopted by Britton and Brown in the second edition of the Illustrated Flora of the Northern United States and Canada.

The objections to this method of arriving at a generic name are three: it is merely arbitrary or formal; it is likely to contravene long usage; it may not represent what the author really meant by his genus. Generic limits in the early days often were not defined. The fact that Linnæus described three species of the Pepo kind should have more weight, other things being equal, than the incident (and probably the accident) that a single other species happened to be entered first on his page. Subsequently he added a fourth species of the Pepo kind, *C. ovifera.* Moreover, the early botanists whose preferences have been accepted interpreted Cucurbita to include the Pepo relationship and the binomials have proceeded on that basis, and I am not aware that the old binomials made

under Pepo for the pumpkins and squashes have been revived in recent time. I am holding the name Cucurbita for these plants.

The genus Cucurbita was defined by Linnæus as early as 1737, in the first edition of Genera Plantarum. He had earlier listed Pepo, without definition, but abandoned it. Philip Miller also discarded Pepo in favor of

CUCURBITA.

lagenaria. 1. CUCURBITA foliis ſubangulatis tomentoſis baſi ſubtus biglandulofis, pomis lignoſis.
Cucurbita feminibus obſolete bicornibus. *Hort. cliff.* 451. *Hort. upſ.* 291. *Mat. med.* 442. *Roy. lugdb.* 263.
Cucurbita oblonga, flore albo, folio molli. *Bauh. pin.* 313.
Cucurbita lagenaria, flore albo. *Moriſ. hiſt.* 2. *p.* 23. *ſ.* 1. *t.* 5. *f.* 3.
Habitat in Americæ *riguis.* ☉

Pepo. 2. CUCURBITA foliis lobatis, pomis lævibus.
Cucurbita ſeminum margine tumido. *Hort. cliff.* 452. *Hort. upſ.* 291. *Roy. lugdb.* 263.
Cucurbita major rotunda, flore luteo, folio aſpero. *Bauh. pin.* 213.
Cucurbita indica rotunda. *Dalech. hiſt.* 616.
β. Pepo oblongus. *Bauh. pin.* 311.
Habitat - - - - ☉

verrucoſa. 3. CUCURBITA foliis lobatis, pomis nodoſo-verrucoſis.
Cucurbita verrucoſa. *Bauh. hiſt.* 2. *p.* 222.
Melopepo verrucoſus. *Tournef. inſt.* 106.
Habitat - - - - ☉

Melopepo. 4. CUCURBITA foliis lobatis, caule erecto, pomis depreſſo-nodoſis.
Melopepo clypeiformis. *Bauh. pin.* 312.
Cucurbita clypeiformis ſ. Siciliana. *Bauh. hiſt.* 2. *p.* 224.
Habitat - - - - - ☉
Cirrhi *ſunt in caule, quamvis non ſcandat, nec procumbat.*

Citrullus. 5. CUCURBITA foliis multipartitis. *Hort. upſ.* 3. *Mat. med.* 443.

Cu-

FIG. 33.—THE CUCURBITA PAGE of Linnæus, 1753.

the Cucurbita of Linnæus in his revised edition of the Dictionary, 1768. Linnæus cited three plates of Tournefort, Institutiones Rei Herbariæ, 1700, Cucurbita, Pepo, Melopepo. These Tournefortian pictures are reproduced in Fig. 34; it is readily seen that the Cucurbita is the calabash gourd, now known as Lagenaria. But Linnæus did not found his generic character on the Cucurbita part of the reference but merely took over the

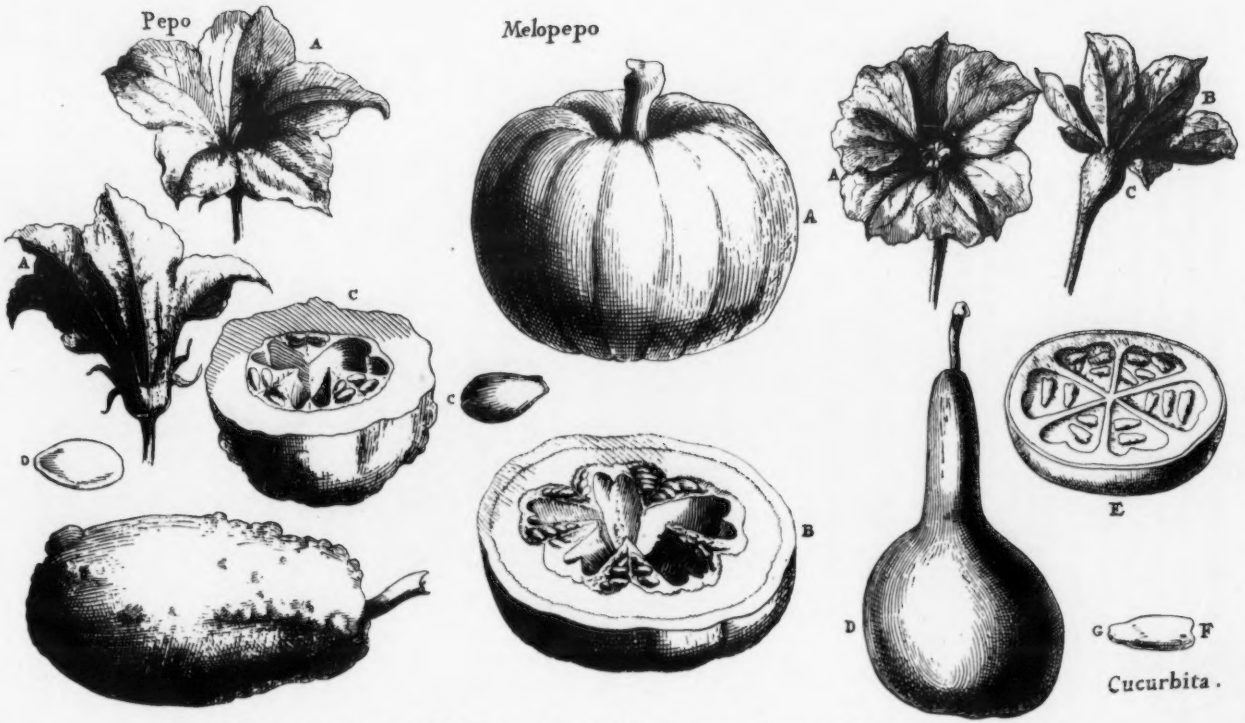


Fig. 34. Tournefort, 1700.—The three groups cited by Linnæus in founding his new genus Cucurbita.

name, and long before Tournefort the name Cucurbita had been used for Pepo plants: he describes the fruit as three-loculed, for example, yet Tournefort's Cucurbita is described and figured as six-loculed, his Melopepo as five-loculed, his Pepo alone as three-loculed; he does not include a description of the peculiar seed of Tournefort's Cucurbita, and the seeds were important characters in the early diagnoses. Cucurbita as a genus of plants in nomenclature begins with Linnæus and not with Tournefort. The reference to Tournefort is important as showing the plants that Linnæus included in his genus Cucurbita; and we shall need to refer to these pictures again. We shall find that the conception of Linnæus' *Cucurbita Melopepo* is different from Tournefort's genus of that name.

We eliminate the white-flowered gourd and the watermelon from our consideration. Then the problem remains of accounting for *Cucurbita Pepo, C. verrucosa, C. Melopepo, C. ovifera.* The well-recognized species of the three is *C. Pepo*, the identification of which is understood. It may be taken as the typical or at least the standard representative species of the genus, in terms of which the other species may be judged and defined.

Cucurbita Pepo.

A Cucurbita with lobed leaves and smooth fruits was what Linnæus named *Cucurbita Pepo.* He refers to five works as further evidence,—*Hort. cliff., Hort. ups., Roy. lugdb., Bauh. pin., Dalech. hist.*; these books we must now consult; the dates are editions available to me.

Hortus Cliffortianus, 1737, is a quarto volume prepared by Linnæus, published in Amsterdam, giving an account of the plants cultivated in the gardens of George Clifford. The reference is to "Cucurbita seminum margine tumido," and that phrase in Hort. Cliff. (in which "integro" is added) is in distinction from the obscurely two-horned seed of Lagenaria (Cucurbita seminibus obsolete bicornibus), and from the different seed of the watermelon. Hortus Cliffortianus refers in turn to other books, but it does not follow that Linnæus intended to include all these references as definitions of *C. Pepo* when he compiled Species Plantarum. Hort. Cliff. does not aid us except in its citations of other works, and these are accounted for as we proceed.

Hortus Upsaliensis, 1748, is an account by Linnæus of the plants growing in the garden at Upsala. It does not give additional information for our purpose.

Florae Leydensis, by Royen, 1740, adds nothing critical.

Caspar Bauhin's Pinax or Theatri Botanici, 1671, is an account of a cucurbita fruit large and round, flowers yellow, leaves rough.

Historia Generalis Plantarum by Dalechamps, 1686-7, gives us a definite starting-point in "Cucurbita Indica, rotunda" with its illustration (Fig. 35). It is a tendril-bearing plant; and the fruit-stems are long, appar-

ently ridged and not enlarged next the fruit; the leaf-shape also answers well for the species we now know as *Cucurbita Pepo*. The hairiness along the stem is undoubtedly exaggerated; and the leaf-bearing to the roots is conventionalized, as well as the mode of fruiting,—these methods of representation were prevalent in those days. This plant must have been something like one of our field pumpkins.

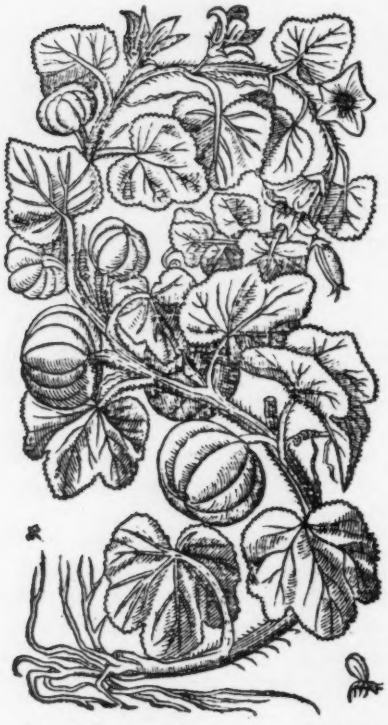


FIG. 35. DALECHAMPS' PICTURE of Cucurbita Indica, rotunda, cited by Linnæus as Cucurbita Pepo.

We are able to trace to another very early picture in corroboration. In Hort. Cliff. and Hort. Ups. reference is made to Pepo vulgaris *Raj. hist.* 639. John Ray's Historia Plantarum, 1686-88, refers to "Cucurbita foliis asperis sive Zuccha flore luteo J. B." The J. B. is Johann Bauhin (& Cherler), Historiæ Universalis Plantarum, 1650-51, the great source-book for these plants, and he gives a picture of the plant (Fig. 36); and this figure is again *C. Pepo* as we know it; Tournefort refers to this picture, and Hort. Cliff. also cites it directly. We meet the word Zuccha (Zucca) in the early writings, as in Ray above; it is Italian for gourd or pumpkin.

At this point we may consider the identity of Tournefort's genus Pepo, the name of which has come down from the herbalists and through Tournefort to Linnæus. Tournefort's picture of Pepo (Fig. 34) is clearly the fruit we know by that name (*Cucurbita Pepo*); and his citations of J. B. (Johann Bauhin) and others show that he had this range of rough and lobed-leaved long-stemmed fruits in mind. Eight of his citations of J. B. are to asperous plants.

The best evidence on the identity of *Cucurbita Pepo*, however, is the specimen left by Linnæus; this is shown in Fig. 37, and the sheet is marked "$_2$ Pepo" in his hand. It is probable that this specimen was not before him

when the Species Plantarum was published, 1753, and he did not found that species on specimens, but it certainly goes back to 1755 and verifies his conception of the species. The photograph (on which the stiff setae show plainly) from which Fig. 37 is made was kindly supplied by the Linnean Society of London, as also that of *C. ovifera* (Fig. 41). A note by Linnæus on the reverse of the sheet (Fig. 37) says that the fruit was clypeate. The photograph shows that we have properly interpreted *Cucurbita Pepo* as to species.

It will be noted that Linnæus has a variety β, which is the Pepo oblongus of Caspar Bauhin's Pinax. In Bauhin the diagnosis is brief, but he refers to earlier pictures of the plant, as to Dodoens' Pemptades (1616) and to Gerard's Herball; from the later work, 1636, Fig. 38 is reproduced, it being the same picture as in Dodoens. This plant with its deeply lobed leaves, is undoubtedly a *C. Pepo* of the vegetable marrow kind although Cogniaux apparently means to refer it to *C. maxima* (Fl. Brasil. vi. pt. iv, p. 19; DC. Monogr. iii, 545), as also does Alefeld in his Landwirtschaftliche Flora. "The great Pompion," writes Gerard, "bringeth forth thicke and rough prickly stalkes . . . . . the leaves be wilde and great, very rough, and cut with certain deep gashes, nicked also on the edges like a saw . . . . the fruit is great, thicke, round, set with thicke ribbs like edges sticking forth." The plant in Fig. 38 is his "Pepo maximus oblongus, The great long Pompion."

FIG. 36.—JOHANN BAUHIN's figure of Cucurbita foliis asperis cited indirectly by Linnæus as one of the sources of his Cucurbita Pepo.

Cucurbita verrucosa.

This plant, in the description, has lobed leaves, and warty fruit. We are able to identify this plant directly by the reference to Bauhin, where it is pictured as *Cucurbita verrucosa*; and the "Melopepo verrucosus" of Tournefort cites the same picture. Johann Bauhin's illustration is reproduced in Fig. 39. It is a running tendril-bearing plant, with long fruit-stems, and tubercled ribbed fruit. The flowers are peculiar, the leaves

very regularly ovate and deeply dentate, but the formalized picture undoubtedly represents one of the warty gourd forms of *Cucurbita Pepo*. In the second and third editions of Species Plantarum the remark is added that the plant, flowers and seeds are like those of *C. Pepo*, but the fruits are smaller and the shell harder or almost woody. There is no specimen named *C. verrucosa* by Linnæus in the Linnean Herbarium.

Fig. 37. CUCURBITA PEPO in the Linnean Herbarium.

Cucurbita Melopepo.

This plant, according to Linnæus, is erect, not climbing or procumbent although he states that it bears tendrils; the leaves are lobed, the fruit depressed or flattened endwise and knotty. It is the "Melopepo clypeiformis" of Caspar Bauhin's Pinax and "Cucurbita clypeiformis" of Johann Bauhin's Historia; the latter has a picture, which is reproduced in Fig. 40; clypeiformis means shield-shaped or buckler-shaped; the plant is undoubtedly what we know as Bush Scallop squash. Bauhin does not mention its stature, and inasmuch as his picture is without tendrils we may assume that it was not a runner.

In the early days, the word melon was often used for the Cucurbitas; thus John Ray says of his Pepo vulgaris, "The common Pumpion, called by the vulgar, The Melon." The Melopepo of classical times was an apple-

shaped melon. The word was variously employed in later times but apparently mostly for short-fruited or round-fruited kinds of what we now know as cucurbitas. It is not necessary here to discuss the classical, medieval or herbalist applications of the word inasmuch as we are at the moment interested only in the plant that Linnæus meant to designate by the word Melopepo.

The Melopepo of Tournefort, 1700, is a mixed group. It differs from his Cucurbita (Lagenaria) as a class, in having nearly rotund fleshy striate and angled five-celled fruits, and in the compressed seeds. Tournefort's picture of the genus Melopepo (Fig. 34) is probably what we know as *Cucurbita maxima*; at least his genus includes plants later separated as *C. maxima*, as shown by the references to pictures in Johann Bauhin in which the leaves are described as not lobed and the fruits as sessile (short-stemmed). However, Tournefort included also the "Cucurbita clypeiformis" and the "Melopepo verrucosa" of J. B.

In the herbarium of Linnæus there is no specimen of *C. Melopepo* named by him.

FIG. 38. CUCURBITA PEPO β of Linnæus.—Gerard's Pepo maximus oblongus.

Cucurbita ovifera.

This species was founded by Linnæus in the first Mantissa, 1767, habitat in Astrachan, collected by Lerche. It was probably only a cultivated plant as Lerche found it. The plant was grown by Linnæus at Upsala. It is described as like *C. Pepo*, but less scabrous; fruit obovate, size of a hen's egg, with hard shell and ten longitudinal lines. It is the egg or pear gourd of later days, with which must now be associated, in one botanical variety, the other small hard fancy gourds. The specimen in the Linnean Herbarium is shown in Fig. 41, and the ovary foretells the oviform or pyriform fruit.

The Linnæan page (Fig. 33) of Cucurbita (1753) works out, therefore, as follows if interpreted as here indicated:

1. **Lagenaria leucantha,** Rusby, Mem. Torr. Bot. Club. vi, 43 (1896).
Cucurbita Lagenaria, Linn. Sp. Pl. 1010 (1753).
Cucurbita leucantha, Duchesne; Lam. Encyc. ii, 150 (1786).

Fig. 39. Bauhin's picture, cited by Linnæus to define his Cucurbita verrucosa.

Fig. 40.—Bauhin's Cucurbita clypeiformis cited by Linnæus as Cucurbita Melopepo.

Lagenaria vulgaris, Seringe, Mem. Soc. Genève, iii, pt. 1, 25 (1829); and genus Lagenaria.
Lagenaria Lagenaria, Cockerell, Bull. Torr. Bot. Club, xix, 95 (1892).

2, 3. **Cucurbita Pepo,** Linn. l.c.
Cucurbita verrucosa, Linn. l.c.

4. **Cucurbita Pepo** var. **Melopepo,** Alef. Landwirth. Fl. 220 (1866).
Cucurbita Melopepo, Linn. l.c.

5. **Citrullus vulgaris,** Schrader, in Ecklon & Zeyher, Enumeratio Plantarum Africæ Australis Extratropicæ, 279 (1835); Linnaea, xii, 412 (1838).

Cucurbita Citrullus, Linn. Sp. Pl. 1010 (1753).

Citrullus pasteca, Sageret, Ann. Sci. Nat. ser. 1, viii, 312 (1826).

Cucumis Citrullus, Seringe in D.C. Prodr. iii, 301 (1828).

Citrullus caffer, Schrad. in Ecklon & Zeyher, l.c.; *C. caffrorum,* Linnaea, l.c.

Citrullus Citrullus, Karsten, Deutsche Flora, 889 (1882).

The sweet or cultivated watermelon, with pink, scarlet or white flesh. Linnæus had the cultivated watermelon, as indicated by the citations and by his supposition that the plant had its habitat in Apulia, Calabria, Sicilia; and we must accept this plant as the taxonomic type of the species. There is a specimen in his herbarium, without indication of date, of which a photograph is before me, and which shows that he had the watermelon in mind.

† **C. vulgaris** var. **lanatus,** n. st.*

Momordica lanata, Thunb. Prodr. Fl. Capens. 13 (1794).

Citrullus amarus, Schrad. in Ecklon & Zeyher and in Linnaea, l.c.

The bitter or wild native watermelon of South Africa. Whether the Citron melon, or preserving watermelon, of the vegetable-garden, is an offshoot of the domesticated or the wild race is to be determined.

THE SYSTEMATOLOGY OF THE CULTIVATED CUCURBITAS

Leading historic systematic treatments of the cultivated Cucurbitas are:

Lamarck, Courge in Encyclopèdié Méthodique, vol. ii (Paris, 1786), founded on the experimental studies of Duchesne. This account is the foundation of our knowledge of the cultivated cucurbitas.

Poiret, Courge in Dictionnaire des Sciences Naturelles, vol. viii (Paris, 1818). It follows closely the account in Lamarck.

Seringe, in DeCandolle's Prodromus Systematis Naturalis, iii, 316 (Paris, 1828).

Roemer, Synopsis Monographica e classe Peponiferarum, being Fasc. ii of his Familiarum naturalium regni vegetabilis, Synopses Monographicae (Weimar, 1846).

Gasparrini, Osservazione diagnostiche e morfologiche sopra alcune spezie di zucche coltivate. Rendiconto della adunanze e de'lavari della Reale Academia delle Scienza di Napoli. v. 5 p. 445-456. 1847. Also, Observations morphologique et physiologique de courges cultivées. Annales des Sciences Naturelles, Botanique, ser. iii, ix, 207-221. 1848.

*n.st., new status (*status novus*): see Gent. Herb. i, p. 8.

Seringe, Flore des jardins et des grand cultures, ii (Lyon, 1849).
Naudin, Nouvelles recherches sur les charactères spécifiques et les variétés des plantes du genre Cucurbita, in Annales des Sciences Naturelles, Botanique, ser. iv, vi, 1-73 (Paris, 1856).
Alefeld, Landwirtschaftliche Flora (Berlin, 1866). This publication invents Latin varietal names for the horticultural kinds of Cucurbita.
Cogniaux, in DeCandolle's Monographiæ Phanerogamarum, iii, 524 (Paris, 1881).

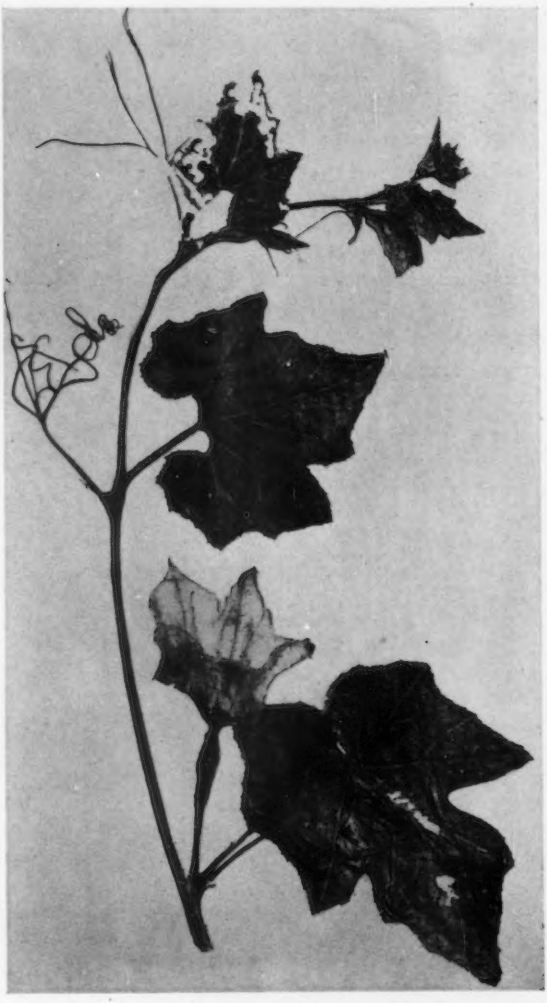


FIG. 41. CUCURBITA OVIFERA, the type specimen in the Linnean Herbarium

There is little doubt as to the main species of Cucurbita in common cultivation, but the systematic placing of the major varieties or races is not so clear. The pumpkins, squashes, marrows, yellow-flowered gourds, are *C. Pepo*, *C. maxima*, *C. moschata*, the largest range of forms falling under the first; and we may also include the black-seeded or Malabar gourd in the reckoning.

The vernaculars.

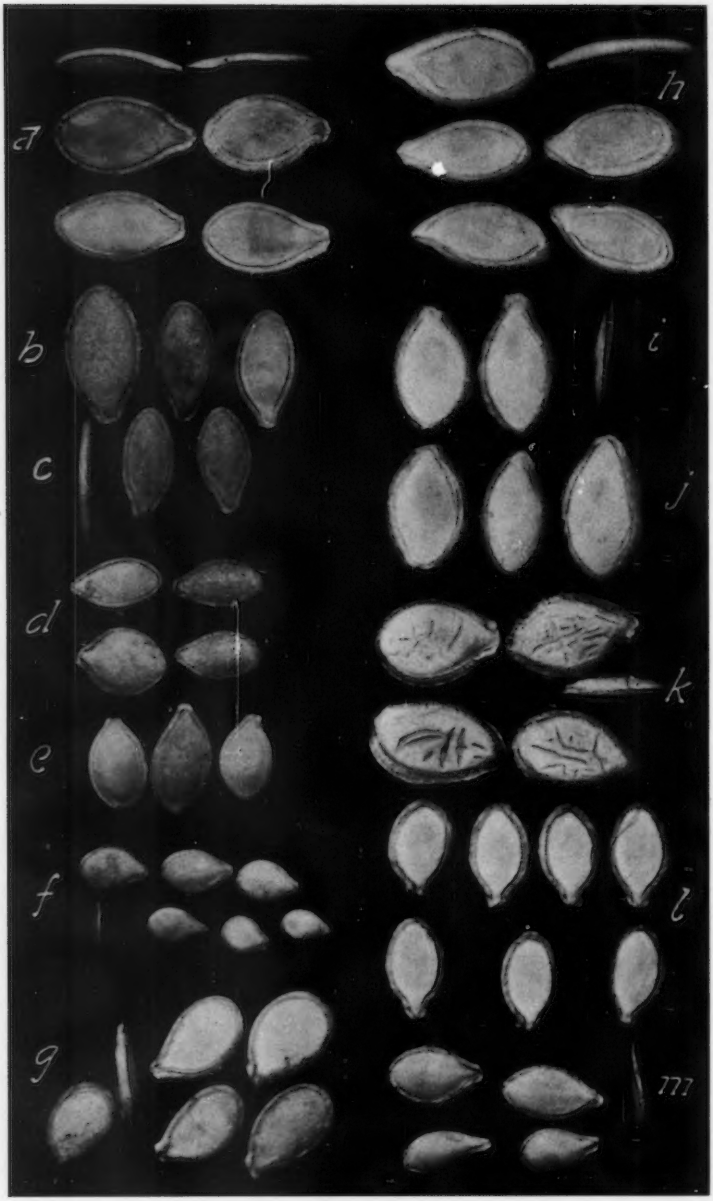
The pumpkin and squash tribes are grown abundantly and in many

diverse forms in North America, for human food, for stock feed, and many kinds for ornament. There is no single vernacular name in use in this country to include them all, although the word cucurbit is now employed among writers and teachers for the plants of the Cucurbitaceæ but often for the Cucurbitas specially. In England the word *gourd* may be used to cover all the Cucurbitas, as in France the word *courge* and in Germany *kürbis*. In North America the name *gourd* is employed for the hard-shelled durable kinds grown for oranment or the shells used as utensils, irrespective of the botanical species to which they belong. Used in this sense, the gourds are of two very different classes,—the white-flowered gourds or lagenarias, and the yellow-flowered gourds or cucurbitas; only the latter are covered in this paper.

The terms *pumpkin* and *squash* have little botanical significance, and it is difficult to apply them arbitrarily, particularly as the plants are differently named in other countries; they are common-language terms of inexact meaning.

The word *pumpkin*, and the colloquial *punkin*, are derivatives from the old *pompion*, *pumpion*, *pompeon*, which has its root in *pepo* or *pepon*. The old word may have been applied first to a melon. Its later application in Cucurbita is indefinite and does not designate any particular botanical class or group. In North America the word pumpkin is habitually applied to the large-fruited forms of *Cucurbita Pepo*, particularly to those varieties grown in field culture and that are sometimes used for stock-feeding, although it is given also to very large forms of *C. maxima*.

The word *squash* is derived from the American Indians. Thus Roger Williams in his "Key into the Language of America," 1643, writes: "Askutasquash—their Vine apple.—Which the English from them call Squashes about the bignesse of Apples of severall colours." John Josselyn writes in his "New-Englands Rarities", 1672: "*Squashes*, but more truly *Squonter-squashes*, a kind of Mellon, or rather Gourd, for they sometimes degenerate into Gourds; some of these are green, some yellow, some longish like a Gourd, others round like an Apple, all of them pleasant food boyled and buttered, and season'd with Spice". Robert Beverley in his "History of Virginia" in 1722 speaks of the shield-shaped or clypeate kinds and says that they are sometimes called cymnels, "from the Lenten cake of that Name, which many of them very much resemble"; he adds that the Northern Indians call them squash or squanter-squash. The term *simlin* or *cymlin* for a scallop or pattypan squash in the Southern United States undoubtedly has this origin from the simnel cake of the early celebrations. The word *squash* does not have a botanical implication, but historically it was probably associated mostly with forms of *Cucurbita Pepo*. At present in North America it is popularly applied to the summer bush forms of *C. Pepo* (the Melopepos), and also to most of the varieties of *C. maxima*,


a
b
c
d
e
f
g
h
i
j
k
l
m

as to Hubbard, Warren, Marrow and Turban squashes; but in England the word *Marrow*, as Vegetable Marrow, is employed for a distinct long-fruited form of *C. Pepo* (Fig. 47). It is seen, therefore, that the vernaculars do not have much significance in identification. Many years ago I attempted to employ the common names in a more definite and logical way, but popular usage did not seem to require careful distinctions.

An effort is now making to range the words *pumpkin* and *squash* with botanical species; thus all the forms of *Cucurbita Pepo* and *C. moschata* become pumpkins and all of *C. maxima* become squashes. The Melopepos, as the Summer Crookneck and the Scallop, are classified as pumpkins. This is the arrangement adopted in the recent Iowa Bulletin 244 by Castetter and Erwin. I do not know that the application has been made to the little ornamental gourds, which are races of *C. Pepo*. With the present discussions of plant-breeding, pathology, and other subjects requiring an exact nomenclature, it is desirable to regularize the vernaculars, although it may not be possible or advisable to standardize them. I hope we may find a way to use the English names with discrimination, and to this end I am in sympathy with the attempt to harmonize them.

The botanical nomenclature.

The most notable of the early attempts in this country to test and publish the edible varieties of Cucurbita by an institution is the Report of the Horticulturist, E. S. Goff, of the New York Agricultural Experiment Station, Geneva, Vol. vi, for the year 1887; the kinds are classified; fifty-five varieties are described, and careful useful keys are provided. Recent analytical treatments in North America are Werkenthin, Description and Key of the Genus Cucurbita, Proc. Iowa Acad. Sci. xxix, 281 (1922); Russell, Identification of the commonly cultivated species of Cucurbita by means of seed characters, Journ. Wash. Acad. Sci. xiv, 265 (1924); Castetter and Erwin, A Systematic Study of Squashes and Pumpkins, Bull. 244, Iowa Exper. Sta. (1927). All these papers are good discussions in the systematology of the cultivated Cucurbitas. The widespread notion that plants long modified by domestication are thereby incapable of systematic botanical investigation is an unfortunate prejudice and is contradicted by many studies.

Seed characters are important in distinguishing the species of Cucurbita (Fig. 42) and we may use them in a key; and the same is true of the mature peduncle or fruit-stem (Fig. 43). The covering or armature of

FIG. 42. DRY SEEDS OF CUCURBITA.—*a-f*, Cucurbita Pepo: *a*, Large Field pumpkin; *b*, *c*, Vegetable Marrow; *d*, Summer Crookneck; *e*, White Bush Scallop; *f*, Bicolor Pear-shaped gourd.—*g*, *h*, Cucurbita maxima: *g*, Turks-cap gourd; *h*, Hubbard squash.—*i-m*, Cucurbita moschata: *i*, *j*, Striped Cushaw pumpkin; *k*, Japanese Pie pumpkin; *l*, a Chinese variety; *m*, Platter grüner gourd (German).

petioles and stems is indicated in Fig. 44. The character of leaves and flowers appear as we proceed. The seed references and descriptions suppose dried seeds only, as they appear in seed-packets or at planting time.

The white-seeded pumpkins, squashes, gourds: annual. (Seeds clear white or at most dingy or tawny).

Seeds obtuse- or thick-edged: cup or tube of calyx in staminate flowers commonly prominent and bell-shaped, the lobes not or seldom foliaceous: peduncle or fruit-stalk rarely if at all greatly expanded or flared at junction with fruit: leaves and growths prickly or with setae among the hairs.

Plant rough (setose-prickly): leaves mostly strongly lobed, with deep narrow obtuse sinuses, or else grape-vine-lobed: peduncle hard and strongly and deeply 5-angled, either without or with an expanded attachment: tips of corolla segments connivent (bud pointed) in the bud the evening preceding anthesis: seeds dingy or not clear white (more or less tan-white), thin and flat, mostly with raised or prominently differentiated regular clean margin or rim, the apex prevailingly straight or sometimes merely blunt..... 1. *C. Pepo*

Plant not harsh or prickly, the setae small and interspersed with soft hairs: leaves rounded in outline, only obscurely if at all lobed: peduncle short, spongy, practically cylindrical, not expanded: tips of corolla segments open or spreading in bud evening preceding anthesis: seeds prevailingly clear white, plump and thick, the regular clear rim mostly not conspicuously elevated, apex oblique..... 2. *C. maxima*

Seeds bearing a thin or a ragged deeper-colored margin which is more or less wavy and shreddy and somewhat hyaline, apex slanting or obtuse, body often pitted or sculptured: calyx-tube of staminate flowers prevailingly short or almost none, the lobes frequently foliaceous: peduncle 5-angled and widely expanded at attachment, often very long: tips of corolla segments connivent in bud evening before anthesis: leaves and growths soft-hairy, without prickly setae, the leaves only shallowly or grape-vine-lobed..... 3. *C. moschata*

The black-seeded gourd: perennial in warm countries. (Seeds clear-black or brown-black). ..... 4. *C. ficifolia*

1. **Cucurbita Pepo,** Linn. Sp. Pl. 1010 (1753).

Pepo vulgaris and *P. verrucosus,* Moench, Meth. Pl. 653 (1794).

Pepo citrullus, Sageret, Ann. Sci. Nat. ser. 1, viii, 311 (1826). This name is applied to the watermelon in literature, but Sageret's account clearly shows that he had in mind *Cucurbita Pepo,* at least in great part.

Harsh-leaved summer, autumn and winter pumpkins.—The fruit described by Linnæus under this name was smooth (*laevibus*), the leaves were lobed. The one picture to which he refers is "Cucurbita indica

rotunda" of Dalechamps (Fig. 35), and this was a tendril-bearing vine. I therefore take the typical or standard form of *C. Pepo* to be smooth furrowed round-fruited or oblong running forms; common field pumpkins of North America come within this group.

As a whole, *Cucurbita Pepo* is known by the harsh prickly armature of the stems and leaves, stiff and more or less rigid, erect or upright foliage, the leaves with a broad triangular-pointed outline and often with deep lobes: corolla mostly with erect or spreading (not drooping) pointed lobes, the tube narrowing toward the base: peduncle strongly 5-angled and little or much expanding next the fruit.

FIG. 43. PEDUNCLES OR FRUIT-STALKS.—*a, b*, Cucurbita Pepo; *a*, Connecticut Field pumpkin; *b*, Italian pumpkin (Courge d'Italie).—*c, d*, Cucurbita moschata: *c*, collection in Venezuela; *d*, Chinese variety.—*e, f*, Cucurbita maxima: *e*, Chinese; *f*, Baleine (Courge baleine).—About three-fourths natural size.

Lamarck (Encyc. ii, 151) adopts *Cucurbita Pepo* as a general name, citing Duchesne as authority, and then ranges the forms under two groups,—*C. Pepo moschata* (which later, under another hand, becomes *Cucurbita moschata*), and *C. Pepo polymorpha*, or, in his subsequent usage, *Cucurbita polymorpha*. The var. *polymorpha* covers apparently all the forms of *C. Pepo* then known, from fancy gourds to pattypans and pumpkins; it comprises the Linnæan names *C. Pepo*, *C. verrucosa*, *C. Melopepo*, *C. ovifera*. This var. *polymorpha* is too miscellaneous to be employed as a botanical varietal name.

Poiret, 1818, does not give us a botanical treatment of the Pepo forms. The subdivision of Pepo by Seringe in the Prodromus, 1828, is only into the subrotund and oblong fruit forms, and Roemer does little more. Seringe in 1849 does not provide a treatment that we can follow today, at least not in North America, and the same is essentially true of the Naudin work of 1856. Alefeld makes a great number of Latin names representing cultivated varieties, under seven varietal divisions, but it is difficult to incorporate them into a systematic treatment. Cogniaux does not undertake varieties.

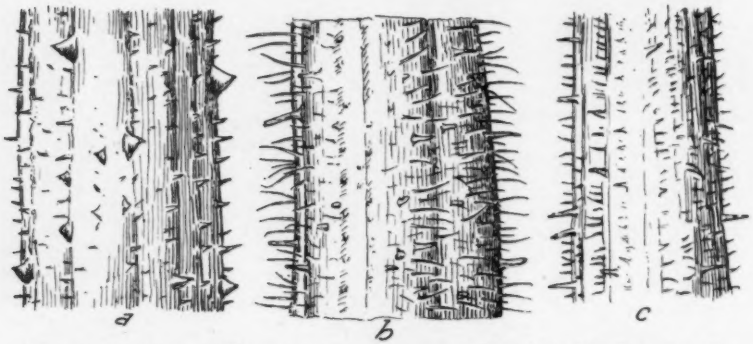


FIG. 44. ARMATURE OF CUCURBITA PETIOLES.—*a*, Prickly stalk of C. Pepo; *b*, soft-hairy of C. moschata; *c*, hairs and rather stiff setae of C. maxima.

It is evident that we must break away from the early systematic arrangements under *C. Pepo*, and fortunately the rules of nomenclature do not require us to follow such varietal names through all their different ranks. It is practically impossible to classify on fruits alone, unless one is attempting only an olericultural treatment. The warty pumpkins and squashes are not a botanical or even a cultural group; they may be *C. Pepo*, *C. Pepo* var. *ovifera*, *C. Pepo* var. *Melopepo*. There are clearly three major groups of cultivated Pepo:

Cucurbita Pepo, Linn. Pumpkins (of North America).—Plants stout and big, tendril-bearing, long-running, with heavy foilage: fruits large, soft-shelled, edible, of many sizes and shapes, the peduncle commonly not expanded at attachment.—Here are to be listed the common field pumpkins, vegetable marrows, Table Queen (Des Moines), Sugar pumpkin. Some of the marks and forms of *Cucurbita Pepo* are seen in Figs. 45, 46, 48, and in the succeeding five numbers. The distinct group of vegetable marrows (Fig. 47) is named *C. Pepo* var. *medullosa* by Alefeld.

Cucurbita Pepo var. **ovifera,** Alef. Landwirth. Fl. 224 (1866), emend. *Cucurbita ovifera,* Linn. Mantissa, i, 126 (1767).

Yellow-flowered gourds (in distinction from white-flowered or calabash gourds, Lagenaria).—Plants mostly slender but often running great distances, tendril-bearing, the foliage mostly less full and heavy: fruits small, hard-shelled and inedible, bitter, the shells keeping indefinitely, in many sizes, shapes and colors. — Although the fruits of many varieties are very distinct, yet the kinds interbreed freely and nondescript inter-grades are abundant. Here are placed the many interesting fancy gourds raised for ornament, utensils and interest. Many of them are named from the shape and markings of the little fruits, as Apple, Bell, Bicolor, Bishop's Mitre, Egg, Löffel (Spoon), Miniature, Orange or Mock Orange, Pear, Warzen (Warty), Zwiebel (Onion). Ovifera forms are pictured in Figs. 48, 49, 50. They are always interesting.

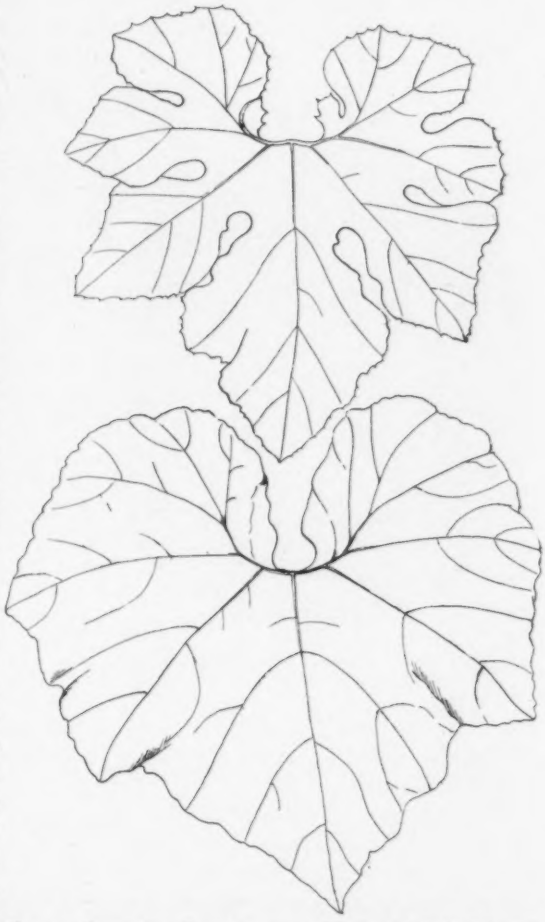


FIG. 45. CUCURBITA PEPO LEAVES.—Characteristic leaf-shapes of the species; above, Apple gourd, below, Egg gourd. C. Pepo var. ovifera.

Cucurbita Pepo var. **Melopepo**, Alef. Landwirth. Fl. 220 (1866), emend.

Cucurbita Melopepo, Linn. Sp. Pl. 1010 (1753).

Cucurbita polymorpha var. *Melopepo*, Duchesne; Lam. Encyc. ii, 157 (1786).

Pepo Melopepo, Moench, Meth. Pl. 654 (1794).

Cucurbita Pepo var. *condensa*, Bailey, Cyclo. Amer. Hort. 409 (1900).

FIG. 46. FIELD PUMPKIN.—One of the standard forms of Cucurbita Pepo.

Bush summer pumpkins (or squashes).—Plants erect and compact or becoming more or less decumbent with age, not scandent or running but tendrils sometimes well developed, internodes very short: fruits of diverse kinds, soft-shelled or at least not durable, edible before maturity, the peduncle often much expanded at attachment: peduncle of staminate flowers commonly much elongated.—The better known summer bush varieties fall into two main groups, the scallop or patty-pan or custard-marrow kinds (patissons) and the crooknecks. However, these divisions are not widely separated, as there are other and more or less intermediate forms, as the Cocozelle Bush and some of the longer custard kinds (see Fig. 51) and the pineapple forms; the forms freely intercross (See Fig. 28). As the definition is here made, the Melopepos constitute a cultural group, and it can not be divided botanically without introducing too many contradictions. The Melopepos are represented in Figs. 40, 51, 52, 53. The nature of the tendrils in the patissons is interestingly stated by Lamarck, presumably from the observations of Duchesne, in his account in 1786. There is no hard-and-fast line between the Melopepos and running pumpkins. Some Pepo horticultural running varieties make only short stems and occupy little room, as the Fordhook.

If one desires a more formal classification of the Melopepos, the following horticultural arrangement may be acceptable:

Var. *Melopepo clypeiformis. The Scallops.*

The shield-shaped or endwise-flattened bush varieties. Here belong the scallop, pattypan or simlin type, as White Bush Scallop, Golden Custard, Kaisermütze, and the Patisson kinds of the French. These are old forms of Cucurbita, abundantly represented in the works of the herbalists.

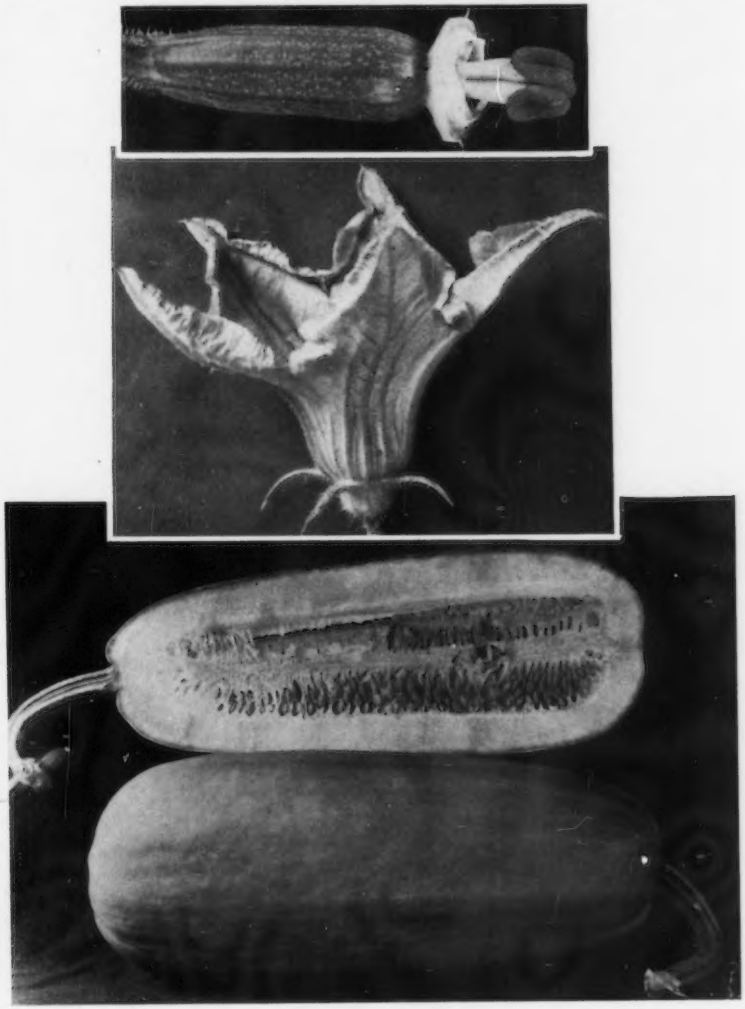


FIG. 47. LONG-FRUITED FORM OF CUCURBITA PEPO.—Vegetable Marrow, fruit, staminate flower, stigmas. Fruit 16 inches long; staminate flower 4 inches across.

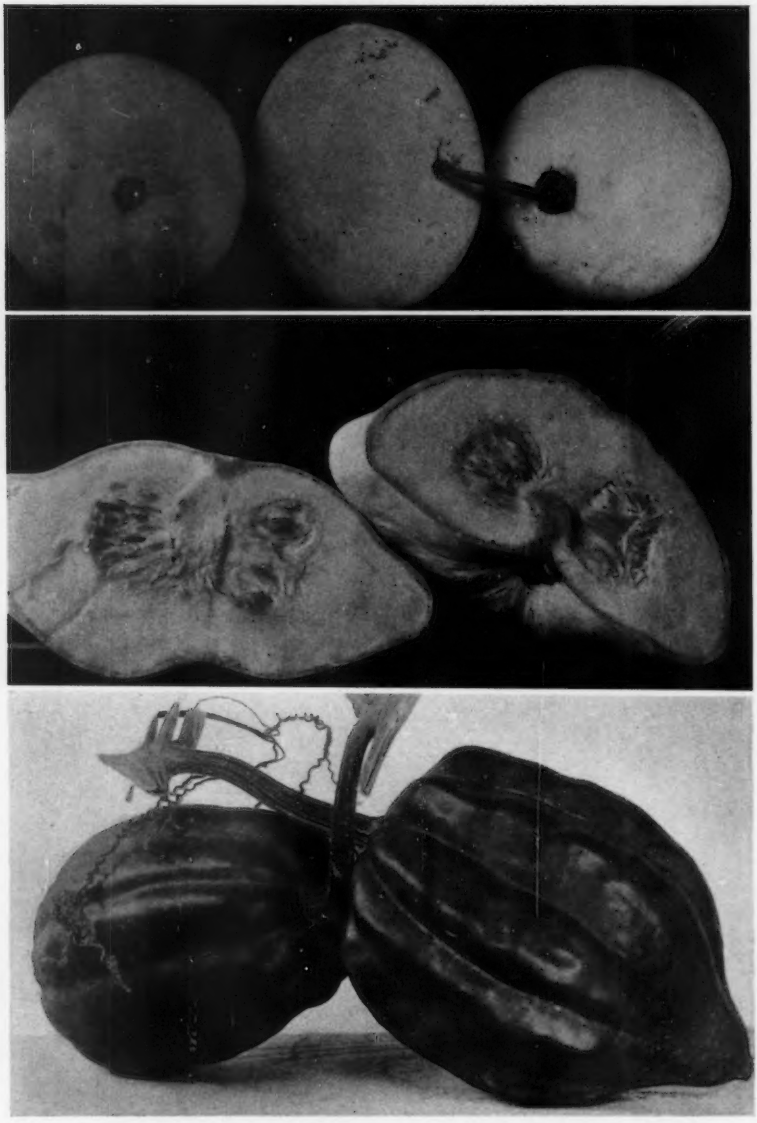


FIG. 48. THE THREE CLASSES OF CUCURBITA PEPO.—Below, Table Queen (Des Moines), about one-half size; Var. Melopepo, White Bush Scallop, half size; Var. ovifera, White Egg gourd, three-fourths size, at top.

Var. *Melopepo torticollis. Summer Crooknecks.*

Cucurbita Pepo var. *torticollis*, Alef. Landwirth. Fl. 219 (1866).

Elongated fruits, mostly thicker in the upper part and usually curved in the first or lower part as they mature. Here may be placed Summer Crookneck and selected strains, as Giant and Golden Summer Crookneck. The Summer Crooknecks are not mentioned by Linnæus; I do not recall a picture of them in any of the herbals. They are likely to be known as American varieties; thus Alefeld speaks of the class as "Crook-neck der Amerik". I have extended the conception of Melopepo to include them.

FIG. 49. PISTILLATE FLOWERS OF GOURDS.—Orange gourd at left, Pear gourd at right. About one-half natural size. Cucurbita Pepo var. ovifera.

The Straightneck Summer squash is apparently a development from the usual crookneck type, and of the same general character aside from its straightness. Pottery of ancient Indians on the west coast of Peru sometimes takes the form of Summer Crooknecks, warts and all (See W. E. Safford, Smithsonian Report, 1926).

Var. *Melopepo varia. Various Bush forms.*

A group to include other non-running Pepos than the Scallops and Crooknecks, as Cocozelle, Genève, Nice, Italie.

2. **Cucurbita maxima,** Duchesne; Lam. Encyc. ii, 151 (1786).

Cucurbita Potiro, Pers. Syn. Plant. ii, 593 (1805-07).

Pepo potiron, Sageret, Ann. Sci. Nat. ser. i, viii, 311 (1826).

Autumn and winter squashes.—The species is well characterized in Lamarck. Two portraits, practically identical, are cited by Lamarck; it is Cucurbita aspera, folio non fisso, fructu maximo, albo sessili, Johann

Bauhin, 2 p. 221 (asperous or rough, leaves not cut or lobed, fruit large, white, sessile); and Pepo maximus indicus compressus of Lobelius, from whom Fig. 54 is taken. Here belong the potirons of the French.

The forms of *Cucurbita maxima* have less rigid and prickly foliage than *C. Pepo* and not so upright in habit, leaves nearly orbicular in outline and

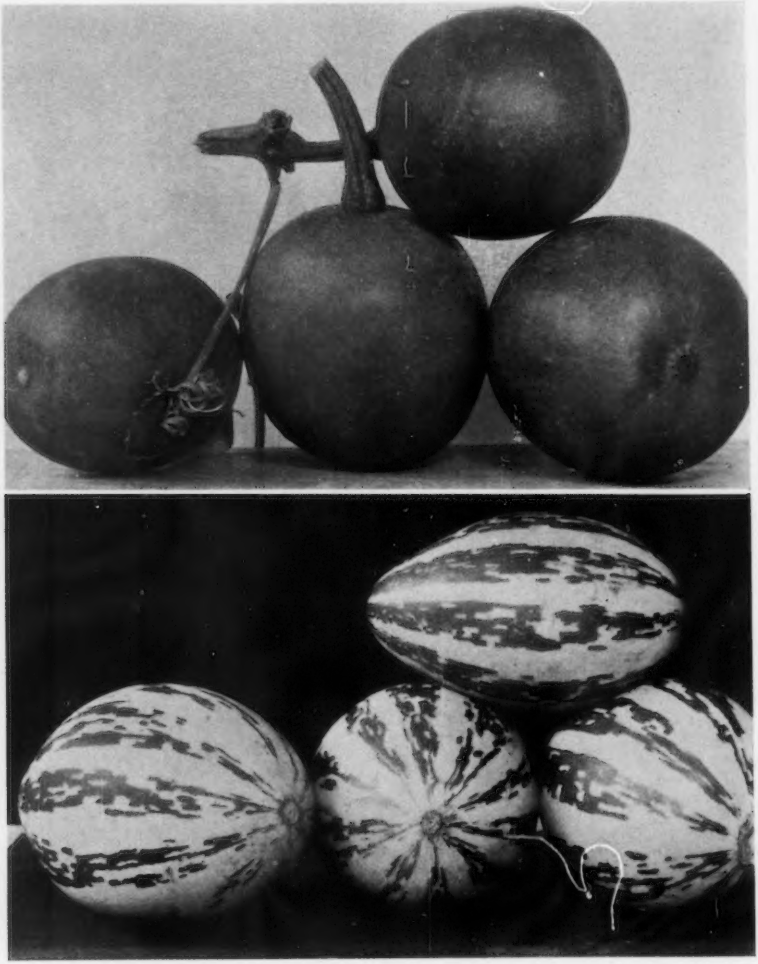


FIG. 50. ORANGE AND PEAR GOURDS.—Cucurbita Pepo var. ovifera; Orange gourd above, dull yellow, half size; Pear gourd below, green and white, two-thirds natural size.

not pointed or much lobed but with deep sinus at base: corolla prevailingly with soft obtuse more or less crinkly revolute or hanging lobes, the tube with parallel sides or bulging at base: peduncle short, spongy, nearly cylindrical, not expanded at attachment to fruit. Characteristics of *Cucurbita maxima* are presented in Figs. 55, 56 and 57.

FIG. 51. A MELOPEPO.—Early Golden Custard, Cucurbita Pepo var. Melopepo. The upper flower, pistillate, was six inches across; fruits nearly one-third natural size.

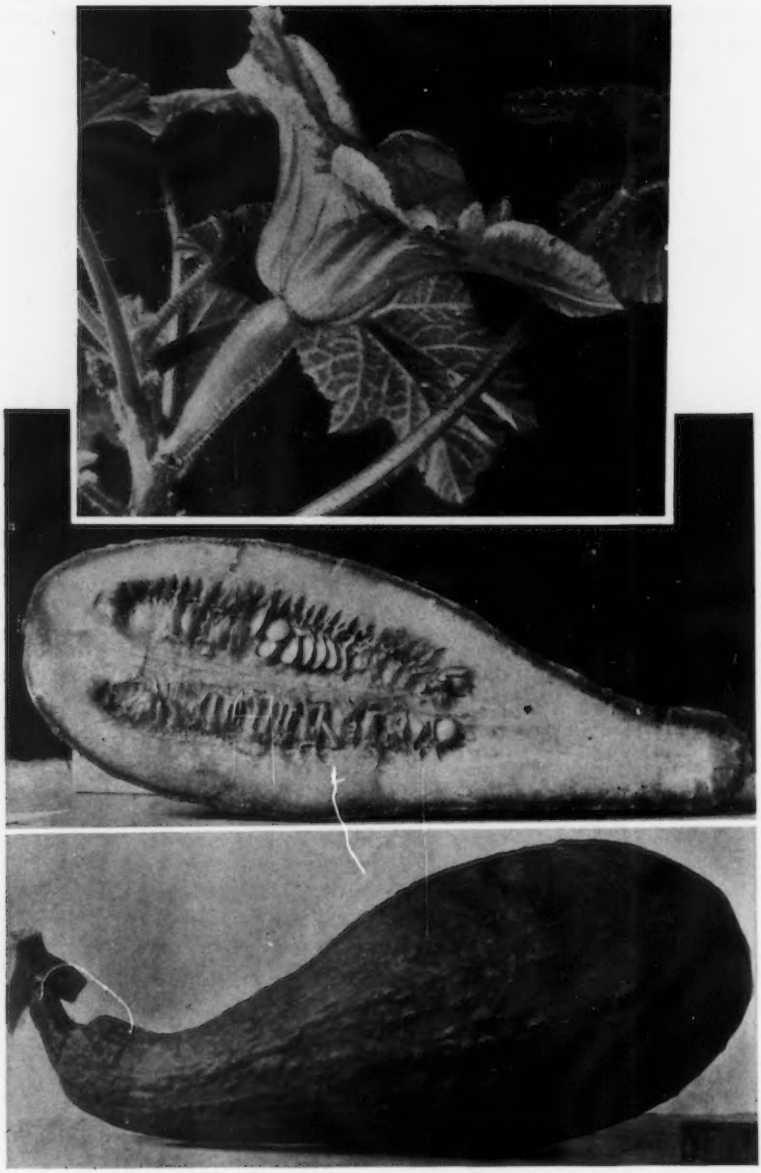


FIG. 52. ONE OF THE MELOPEPOS.—Summer Crookneck, Cucurbita Pepo var. Melopepo. Pistillate flower, three-fourths natural size. Fruit about three-eighths size.

Cucurbita maxima var. **turbaniformis**, Alef. Landwirth. Fl. 212 (1866).

Cucurbita (*Melopepo*) *turbaniformis*, Roem. Syn. Pepon. 87 (1846).

The true truban squashes, or squash-within-a-squash, Fig. 57, *c*, *d*, Fig. 32. See the special discussion, beginning on page 108.

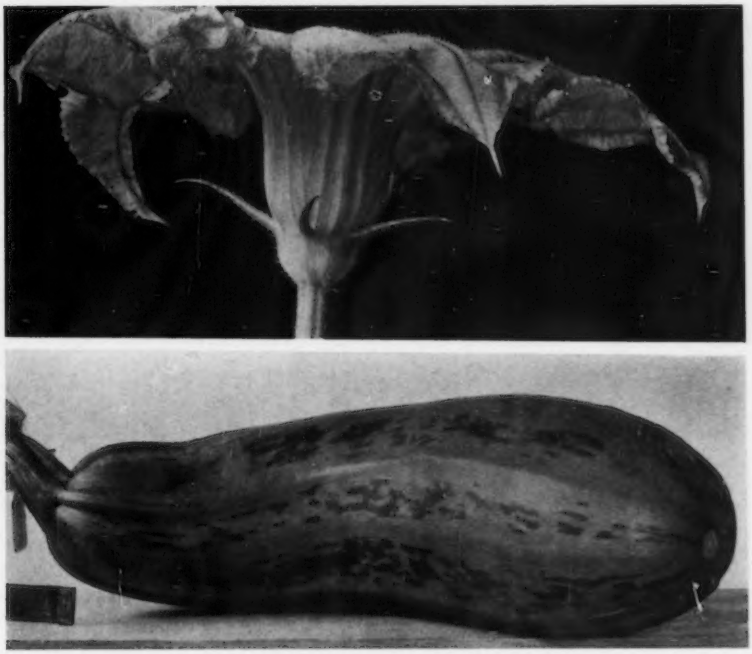


FIG. 53. MELOPEPO.—Cocozelle Bush, Cucurbita Pepo var. Melopepo; flower two-thirds natural size; fruit three-eighths size, yellow striped and marked with green.

All the Maximas are running tendril-bearing plants, although a few of them have very short vines, and the variation is not as wide as with *C. Pepo*. Among Maxima varieties are Hubbard, Marblehead, Bay State. Essex (Essex Hybrid), Mammoth, Chili (Mammoth Chili), Delicious, Boston Marrow, Portugal.

3. **Cucurbita moschata,** Poiret, in Dict. Sci Nat. viii, 234 (1818).

Cucurbita Pepo var. *moschata*, Duchesne; Lam. Encyc. ii, 152 (1786).

Pepo moschatus (*moschatus vel eximius*), Sageret, Ann. Sci. Nat. ser. i, viii, 312 (1826); Britton in Mem. Brooklyn Bot. Gard. i, 96 (1918).

Soft-leaved autumn and winter pumpkins.—The Moschatas are all running tendriliferous plants as far as I know, but they vary greatly in the shape and size of fruit; the forms are of such a nature as hardly to warrant the establishing of botanical varieties for them. Lamarck cites Duchesne as presuming that the "Cucurbita major rotunda" of Caspar Bauhin and "Cucurbita indica rotunda" of Dalechamps are the same, and it is probably on this statement that Poiret definitely cites Dalechamps as a synonym of *C. moschata*; these plants were cited by Linnæus under *C. Pepo*, as we have seen. The soft-hairy grayish character of the plant (Figs. 44, 59) and the absence of stiff setae sufficiently distinguish it, and this attribute is prominently mentioned by both Lamarck and Poiret;

FIG. 54. CUCURBITA MAXIMA, as represented in the Pepo maximus indicus compressus of Lobelius.

therefore I judge that we have properly interpreted the species. Aside from the mollis character, the species is sometimes rather difficult to distinguish from *C. Pepo*, particularly in forms in which the calyx-lobes are not foliaceous and the calyx-cup is developed. The leaves commonly hang limp (Fig. 58), the stout growing axial tip is more or less declined (Fig. 59), and the leaves are never as deeply lobed with rounded sinuses as in the frequent leaves of *C. Pepo* on vigorous growing parts. The leaves are often spotted or marked with white along the veins. The corolla usually has crinkly wide-spreading mostly pointed often somewhat reflexed lobes, the tube little if at all bulging: peduncle 5-angled, often very long, broadly expanding at attachment to fruit (Fig. 43). Figs. 60 and 61 show characteristic flowers and fruits.

To *C. moschata* belong the cushaws and winter crooknecks, in several forms, as also such varieties as Japanese Pie pumpkin, Quaker Pie, Tennessee Sweet Potato pumpkin, Cheese pumpkin, Yokohama. This is the commonest Cucurbita I have seen in the American tropics, and it is sometimes spontaneous.

4. **Cucurbita ficifolia**, Bouché, in Verh. der Ver. des Gartenb. Berlin, xii, 205 (1837).

Cucurbita melanosperma, Gaspar., Act. Acad. Napol. (1847), and Ann. Sci. Nat. ser. iii, ix, p. 208, t. 9; A. Braun, Cat. Hort. Karls. 1824, *nomen nudum*.

Pepo ficifolia, Britton, Sci Survey Porto Rico and Virgin Is (N. Y. Acad. Sci.), vi, 266 (1925).

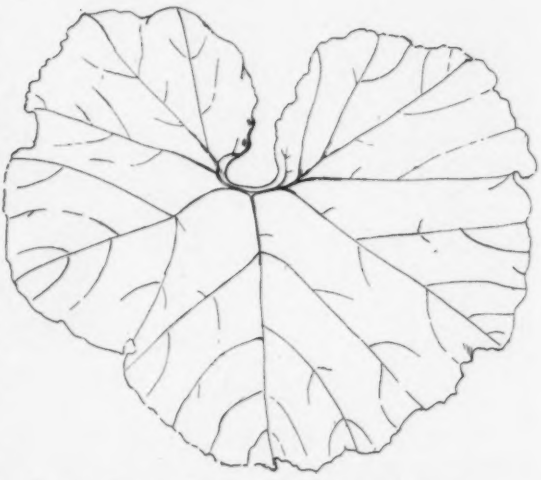


FIG. 55. CUCURBITA MAXIMA var. TURBANIFORMIS.—The Turks-cap gourd.

Malabar or Angora gourd, Fig. 62.—Very vigorous long-running tendriliferous perennial (see Naudin, Ann. Sci. Nat. ser. 5, v, 7) but grown as an annual, setose-prickly: leaves broad- or circular-ovate, to 10 inches across, commonly lobed and fig-like (whence the name *ficifolia*), the sinus obtuse when deep, more or less rough-hairy: corolla yellow to light orange, with thickish obtuse lobes sometimes having involute margins, the pistillate to 5 inches across: fruit very variable, commonly oblong to nearly globular, 5-6 inches diameter, green with white stripes and blotches, rind hard, flesh white: seeds Pepo-like but black or brown-black. Probably Asian; sold by seedsmen; grown for ornament and interest, and sometimes eaten. It is also known as "Courge de Siam".

In Sageret's discussion of hybridity, 1826, in Annales des Sciences Naturelles, Botanique, ser. i, viii, 294-314 (Considérations sur la Production des Hybrides, des Variantes et des Variétés en général, et sur celles de la famille des Cucurbitacées en particulier) the name *Pepo malabaricus* is

FIG. 56. MAXIMA FORMS (*Cucurbita maxima*).—*a*, *b*, Hubbard squash, pistillate and staminate; *c*, *d*, Turks-cap gourd, pistillate and staminate; *e*, *f*, Essex Turban squash, staminate and pistillate.

FIG. 57. MAXIMA FRUITS (*Cucurbita maxima*).—*a*, Hubbard squash; *b*, Chinese form; *c*, Essex Turban; *d*, Turks-cap gourd.

proposed for the "melon de Malabar", but the account is so meager as to make it at least a *nomen dubium*; if it really applies to the plant we now know as Malabar gourd it is the oldest specific name and would displace *Cucurbita ficifolia* if the transfer were made, but I have not cared to take it up without further evidence.

THE CASE OF THE TURBANS

The plants known as Turban squashes are forms of *Cucurbita maxima*, of the kind pictured at *c* and *d* in Fig. 57, and also in Fig. 32. These plants represent a squash-within-a-squash, as explained on page 77. These are the giraumons of the French. Commonly these squashes are as soft-shelled as the Hubbard and edible at maturity, but sometimes they are very hard-shelled, small and gourd-like, as in the Turks-cap gourd at *d* in Fig. 57. There are peculiarities in the stigmas of these squashes that need further investigation. The word turban, as well as emperor's-cap (Kaisermütze), has been applied, however, to forms of *Cucurbita Pepo* var. *Melopepo*. The morphology of the flower of the turbans is suggested in Fig. 594 in the Cyclopedia of American Horticulture, which is repeated as Fig. 1131 in the Standard Cyclopedia of Horticulture.

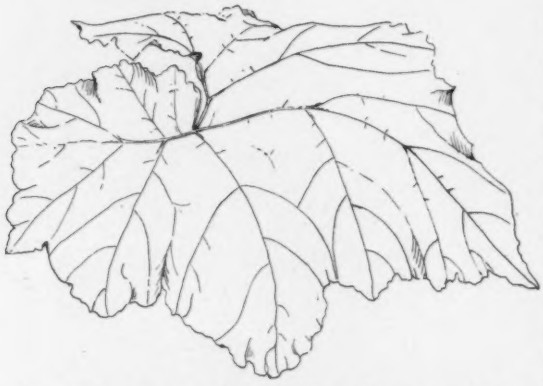


FIG. 58. CUCURBITA MOSCHATA.—Large Cheese pumpkin; a lobed leaf on vigorous growing vine.

In 1846 M. J. Roemer undertook a botanical arrangement of the cucurbitas (Synopsis Peponiferarum, comprising Fasc. ii of his Synopses Monographicae), and the various turban kinds known to him were named and classified. He proposed the names *C. pileiformis* (*pileus*, a cap) and *C. turbaniformis*. The former name is attributed to Duchesne; Poiret had earlier written the name *C. piliformis*, also with Duchesne's name. Cogniaux places both *C. pileiformis* and *C. turbaniformis* in *C. maxima*; Alefeld, however, places the former as *C. Pepo* var. *pileiformis* and the latter as *C. maxima* var. *turbaniformis*, thereby making the proper separation, I think, as to species.

Roemer places his *C. pileiformis* under his subgenus Pepo, along with *Cucurbita Pepo* and the various forms of gourds, in the division with rough foliage; it has 5-lobed leaves, a cap-shaped fruit, and seeds with scarcely swollen margins. The plant is said to be allied to *C. verrucosa*, which is one of the many forms of *C. Pepo*. I do not know just what fruit Roemer had in mind. The *Cucurbita turbaniformis* is placed by Roemer in his subgenus Melopepo, but he specifies the Melopepo of Tournefort rather than of Linnæus; this subgenus has cordate obtuse denticulate leaves only some-

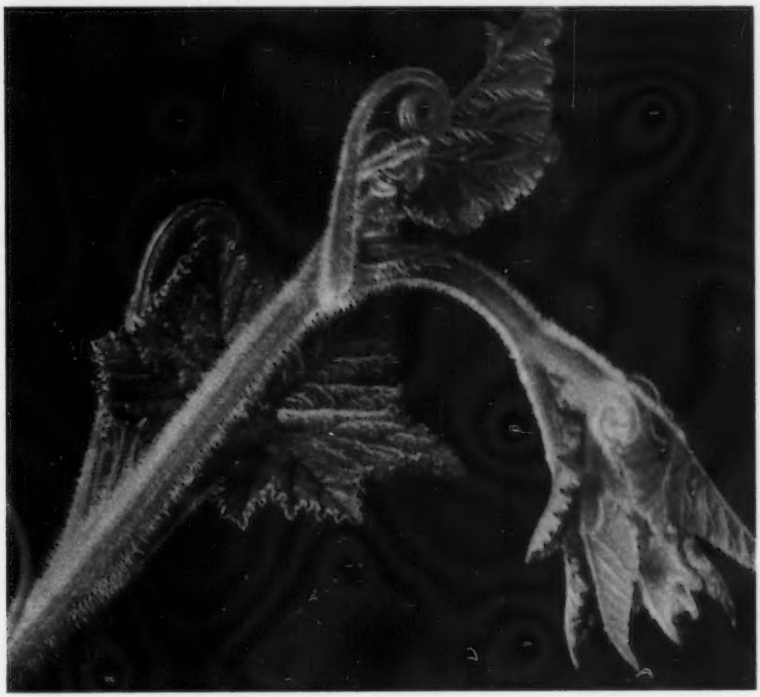


FIG. 59. CUCURBITA MOSCHATA.—Soft-hairy growing tip, with naturally declined end. Large Cheese pumpkin.

what lobed ("sub-5 loba"), tendrils sometimes imperfectly transformed into leaves, compressed fruits. His *C. turbaniformis* calls for a fruit rolled and dilated at base and pushed forward from the interior into a smaller striate projection or part, closely representing a turk's cap. The wound or rolled Turkish turban is much the shape of the turban form of *Cucurbita maxima* and is very different from the pileus or liberty cap, the emperor's

cap or the bishop's mitre. I assume that Roemer meant to designate the fruit we know as Turban squash.

In 1847 Gasparrini founded the genus Pileocalyx apparently to designate the plant we now know as Turban squash. The species is *Pileocalyx elegans*, which Naudin, Alefeld and Cogniaux refer to *Cucurbita maxima*, a disposition I accept. Gasparrini describes a morphology (in Ann. Sci. Nat. Bot.

FIG. 60. CUCURBITA MOSCHATA.—Pistillate and staminate flower, and stigmas, of Large Cheese pumpkin. More than half size. Note the soft-hairiness.

ser. iii, vol. ix, 218-221) that I cannot identify unless it belongs with the Maxima turbans; his plant is sarmentose and climbing, leaves nearly orbicular and lightly lobed. The inferior or lower part of the fruit is hemispherical and resembles a cap ("ressemble à un bonnet"); this part is interpreted to represent the enlarged calyx after fecundation. The upper part of the fruit, of a very different nature, is a large projection terminating in three or four lobes or bosses.

But the difficulty in interpreting Gasparrini's account arises from his citation of old illustrations, properly indicated as rude or crude, representing what he considers to be varieties or species of his genus; these pictures represent what we know as the Bush Scallop type, and come within the range designated in the present paper as *Cucurbita Pepo* var. *Melopepo*. His first citation is to "Cucurbita capitata" in Tabernaemontanus, Eicones Plantarum, t. 475 (1590). This picture is reproduced in Fig. 63. This portrait, reversed and slightly modified, appears in Johann Bauhin, p. 225, and is also cited by Roemer. Another cited picture is "Pepo Indicus minor clypeatus," t. 473 of Tabernaemontanus; this is reproduced in Fig. 64. Another is *Cucurbita clypeiformis, sive Siciliana* of Johann Bauhin; this is seen in Fig. 40. It is apparent that these pictures, with the deeply lobed leaves and characteristic fruits, cannot be referred to *C. maxima*.

FIG. 61. FORMS OF CUCURBITA MOSCHATA.—*a*, Winter Crookneck or Mammoth Golden Cushaw pumpkin; *b*, taken in market, Caracas, Venezuela; *c*, form from China; *d*, [illegible] Striped Cushaw pumpkin; *e*, form from Japan; *f*, Winter Luxury pumpkin.

SYNONYMY IN THE CULTIVATED CUCURBITA GROUP

Following are suggested dispositions of such published Cucurbita names, not already accounted for, as I have been able to consult in the original publications.

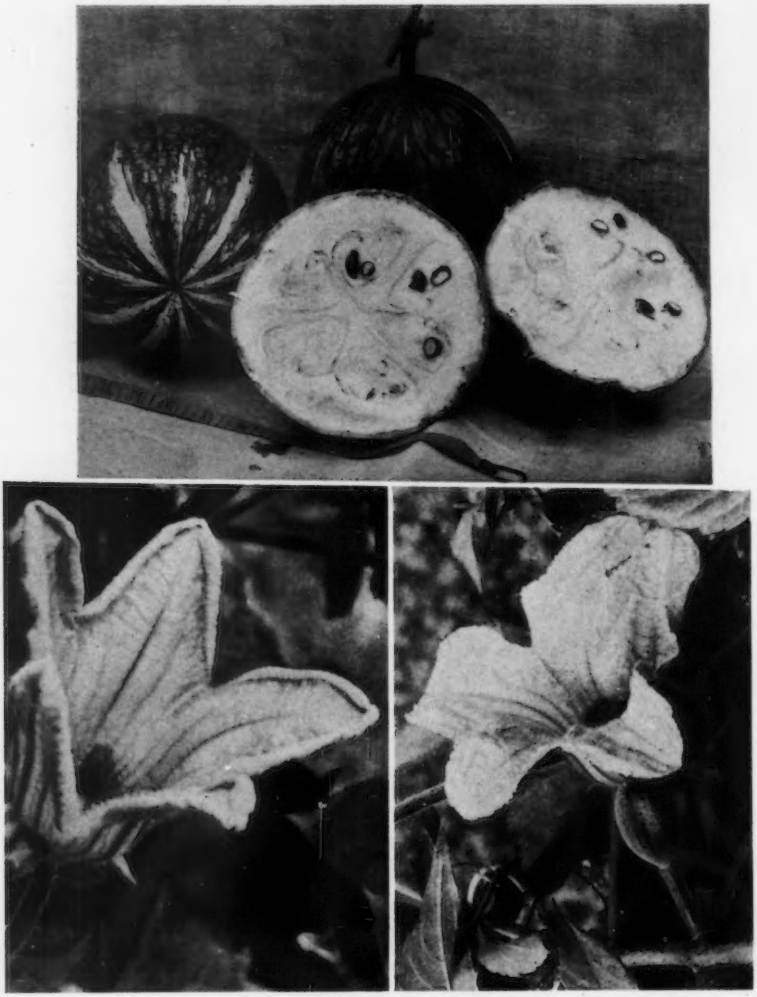


FIG. 62. CUCURBITA FICIFOLIA.—The Malabar or Angora gourd; fruit about one-fourth natural size.

aurantia, Willd. Sp. Pl. iv, 607 (1805).
The Orange gourd, **C. Pepo** var. **ovifera.**

ceratoceras, Haberle; Spix & Martius, Reise Bras. ii, 536 (1828).
Brazilian gourd, **C. Pepo**, probably var. **ovifera.**

clodiensis, Naccari, Flora Veneta, v, 52 (1826-28). The description sufficiently indicates **C. Pepo**; but Naccari cites the figure of "Cucurbita longior" of Dodoens Pemptades, 669, saying that the fruit is well pictured and that the foliage is poorly so, but this illustration is Lagenaria. Naccari appears to describe the plant as "Zucca clodiense", but this name is not intended as a Latin binomial; throughout the book he describes his plants under Italian vernaculars, and the botanical name *Cucurbita clodiensis* is entered under the Italian designation.

FIG. 63.—CUCURBITA CAPITATA of Tabernaemontanus, cited by Gasparrini as probably related to his genus Pileocalyx. — Cucurbita Pepo var. Melopepo.

Courgero, Seringe, in Mém. Soc. Phys. Genève, iii (1825), 7; *C. maxima* var. *Courgero*, Seringe, ibid., 29.
Courgeron of the French, **C. Pepo** var. **Melopepo.**

cucumifera, Schrader, Linnaea, xii, 407 (1838).
Nomen nudum; probably **C. Pepo.**

elongata, Schrader, l.c.
Nomen nudum; probably **C. Pepo.**

esculenta, S. F. Gray, Nat. Arrang. Brit. Pl. ii, 552 (1821).
"Eatable gourd"; cites Pepo maximus rotundus of Gerard, which is **C. Pepo.**

Farinae, Mozzotti, Cat. Hort. Neap. as cited by Naudin, Ann. Sci. Nat. Ser. iv, vi, 17 (1856) is **C. maxima.**

fastuosa, Salisb. Prodr. 157 (1796).
A renaming of **C. Pepo.**

grisea, Roem. Syn. Pepon. 86 (1846). **C. Pepo** var. **ovifera.**

hippopera, Seringe, Fl. Jard. et Grand. Cult. ii, 534(1849). **C. moschata.**

lignosa (*lignosus*), Miller, Gard. Dict. Ed. 8, 1768. Miller defines a gourd with rough-lobed leaves and yellow flowers, and a fruit with a hard shell: probably **C. Pepo** var. **ovifera.**

Fig. 64.—Cucurbita Indicus minor clypeatus, Tabernaemontanus, cited by Gasparrini as probably related to his genus Pileocalyx, but undoubtedly one of the forms of Cucurbita Pepo var. Melopepo. Represented as a tendril-bearing plant.

macrocarpa, Gasparrini in Rendic. Acad. Sci. Napol. vi, 447 (1847) seems from the description to be **C. moschata.**

mammosa, J. F. Gmel. Syst. ii, pars. 1, 101(1791).
A citation under an erroneous name of Molina's *C. mammeata*, Hist Nat. Chili, iii; a plant with many-parted leaves and spheroid mammillate fruit, probably a formof **C. Pepo.**

marsupiiformis, Haberle ex Roem. Syn. Pepon. 92 (1846).
Nomen nudum.

maxima, Duchesne; Lam. Encyc. ii, 151 (1786).

medullaris, Haberle ex. Roem. l.c.
Nomen nudum.

melonaeformis, Carr. Rev. Hort. lii, 137 fig. 29 (1880).
C. Pepo var. *melonaeformis*, Makino, Obs. Flora Jap. fasc. viii, 47 (from Tokyo Bot. Mag. xxii, 1908).
The illustration and description sufficiently indicate **C. moschata.**

Melopepo, Linn. Sp. Pl. 1010 (1753).
C. Pepo var. **Melopepo.**

moschata, Poiret in Dict. Sci. Nat. viii, 234 (1818).

oblonga, Link, Handb. i, 643 (1829).
Inadequately described but probably **C. Pepo.**

ovifera, Linn. Mant. i, 126 (1767).
C. Pepo var. **ovifera.**

Pepo, Linn. Sp. Pl. 1010 (1753).

polymorpha, Duchesne; Lam. Encyc. ii, 152 (1786).
Name for the many forms of **C. Pepo.**

pomiformis, Roem. Syn. Pepon. 85 (1846).
C. Pepo var. **ovifera.**

pyridaris,Poiret in Dict. Sci. Nat. viii, 237 (1818).
C.polymorpha pyridaris, Duchesne; Lam. Encyc. ii, 154 (1876), adapted from the *pyriformis* names of the herbalists.
C. Pepo var. **ovifera.**

pyxidaris, DC. Fl. France, iii, 693 (1815) is probably a mispelling of *pyridaris*; there said to be *C. ovifera*; a form of **C. Pepo.**

subverrucosa, Willd. Sp. Pl. iv, 609 (1805).
C. Pepo.

succado, Naeg., Hort. Frib.; Naudin, Ann. Sci. Nat. ser. 4, vi, 29.
C. Pepo.

succedo, Arn. in Hook. Journ. Bot. iii, 278 (1841).
Nomen nudum.

texana, A. Gray, Bost. Journ. Nat. Hist., vi, 193 (1850).
Tristemon texanum, Scheele, Linnaea, xxi, 586 (1848).
Form or race of **C. Pepo.**

tuberculosa, Schrader, Ind. Sem. Hort. Goetting. 1833; Linnaea, Litt., x, 70 (1835-6).
Form of **C. Pepo.**

urnigera, Schrader, Linnaea, l.c.
Form of **C. Pepo.**

verrucosa, Linn. Sp. Pl. 1010 (1753).
C. Pepo.